Registered at the G.P.O. for Transmission to Canada by Magazine Post.

Vol. 47. Ser. A. Part 4. pp. 117–156. APRIL, 1959.

THE REVIEW OF APPLIED ENTOMOLOGY

SERIES A: AGRICULTURAL

ISSUED BY THE COMMONWEALTH
INSTITUTE OF ENTOMOLOGY.

LONDON:
COMMONWEALTH INSTITUTE OF ENTOMOLOGY,
56, QUEEN'S GATE, S.W.7.

Price 6s. net.

Commonwealth Agricultural Bureaux

EXECUTIVE COUNCIL.

J. G. Malloch, M.B.E., Ph.D., *Chairman*, Canada.
A. Perera, *Vice-Chairman*, Ceylon.
W. G. Alexander, C.B.E., United Kingdom.
E. J. Drake, Australia.
V. Armstrong, Ph.D., New Zealand.
J. F. Brooks, *Acting*, Union of South Africa.
S. Krishnamurti, India.
C. K. Reheem, Pakistan.
J. E. Sagoe, Ghana.
J. D. de Silva, Federation of Malaya.
J. E. C. Coventry, Federation of Rhodesia and Nyasaland.
C. E. Lambert, C.M.G., Colonial Territories.
Sir Herbert Howard, *Secretary*, Farnham House, Farnham Royal, Nr. Slough, Bucks.

COMMONWEALTH INSTITUTE OF ENTOMOLOGY

Director and Editor.
E. O. Pearson, M.A.

Assistant Director.
R. G. Fennah, M.A.

Assistant Editor.
R. F. Avery, M.A.

Head Office—c/o British Museum (Natural History), Cromwell Road, London, S.W.7.

Publication Office and Library—56, Queen's Gate, London, S.W.7.

© *Commonwealth Agricultural Bureaux, 1959.*

A CRITICAL REVIEW
of the
TECHNIQUES FOR TESTING INSECTICIDES

By Dr. J. R. BUSVINE

Bound in cloth. *Royal 8vo.* *Pages x and 208 with 50 text figures.*
Price 30s. post free.

The discovery of DDT and a wide range of other powerful new insecticides has made possible considerable advances in controlling insect pests. Before these can be used on a large scale extensive laboratory tests have to be carried out. Their use has, however, been followed in some cases by the development of resistance on the part of the pest treated. Satisfactory techniques for measuring resistance are essential if comprehensive information about existing resistant strains and warning of the emergence of new ones is to be obtained.

The present work is a review of the techniques that have been used for testing insecticides, giving special attention to the influence of the physiological condition of the insects and various physical and mechanical factors which may affect the results. A clear understanding of these matters is required to permit the development of satisfactory standardised methods, with particular reference to insecticide resistance. The book contains 12 chapters as follows:—

1. General principles of insecticide testing.
2. Handling insects in insecticide tests.
3. Standardisation of insects for testing. Part 1—Insecticides; Part 2—Repellents.
4. Stomach poison insecticides.
5. Contact poisons in powder form.
6. Immersion methods.
7. Laboratory spraying apparatus.
8. Apparatus for injection or application of insecticides to individual insects.
9. Exposure of insects on residual films of contact insecticides.
10. Fumigants.
11. Insect repellents.
12. Toxicological statistics.

Also included are an Introduction, Conclusions and a list of over 550 references.

Obtainable from:—The Commonwealth Institute of Entomology, 56, Queen's Gate, London, S.W.7.

ENTOMOLOGICAL LITERATURE
NEW AND SECONDHAND

Large stocks of Separata and Reprints
on all Orders and Entomological subjects

CATALOGUES SENT FREE ON REQUEST

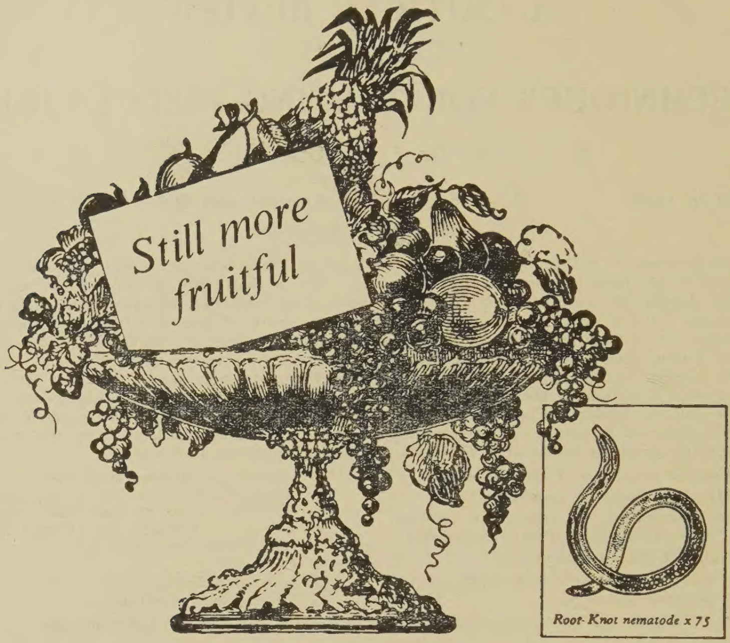
E. W. CLASSEY, F.R.E.S., A.B.A.
Entomological Publisher & Bookseller
4 Church Street, Isleworth, Middlesex, England

WATKINS & DONCASTER
for THE FINEST ENTOMOLOGICAL EQUIPMENT

Specialists in "Special Purpose" Equipment
and Mercury Vapour Light Traps for Insects

Illustrated Catalogue available of Apparatus for all the Natural Sciences

Established 1879
WELLING KENT
Bexleyheath 4347



Root-Knot nematode x 75

Peaches from trees sun-kissed in another continent. Grapes from vineyards half a world away. Oranges from a land where December is summertime. Fruit from the four corners of the world . . . a display once impossible, taken for granted today. Yet, a triumph over odds. Over weather and disease and unending attack by insect pests. And, with ever-mounting success, over the most insidious enemy of all: the vast, unseen host of *nematodes* — root-infesting eelworms of microscopic size, present wherever the soil is cultivated. Every species of plant is believed to be attacked and damage can be immense. Citrus, grapes, bananas, peaches, pineapples, strawberries. Cotton and sugarcane, tea, tomatoes, tobacco . . . the sum total every year of destruction to important crops is beyond computation. But now at last there is promise of complete success. By soil fumigation with advanced chemicals such as Nemagon, developed by Shell.

Nemagon has already achieved outstanding results in eelworm control, at very low, economic dosage rates. More important still — unlike most soil fumigants — *it can safely be used around many growing crops without harming the plant.* In addition, it can now also be combined, in granule form, with fertiliser mixtures, offering at once both a shield and a spur to the crop. With its partner D-D, Nemagon will help to make the world's fields still more fruitful.

Nemagon

Trade Mark

Nemagon is one of a series of six Shell pesticides for world-wide use. Between them, aldrin, dieldrin, endrin, Phosdrin, D-D and Nemagon offer control of almost every significant world pest.

Whatever Shell does, Shell does well.

you can be sure of SHELL chemicals

One of a series of international advertisements issued by
The Shell Petroleum Company Limited, London, E.C.3, England
For further information apply to your Shell Company

McDunnough (J. H.). **Synonymic and biological Notes on Coleophoridae (Lepidoptera).**—*Amer. Mus. Novit.* no. 1827 pp. 1–4, 2 figs. New York, N.Y., 1957.

New synonymy is shown for two of the five species of *Coleophora* discussed. These are *C. serratella* (L.) (*nigricella* (Steph.), *cerasivorella* Pack., *occidentis* Zell., *fletcherella* Fern.), which infests apple and allied plants in Canada, the United States and Europe, and *C. fuscedinella* Zell. (*salmani* Heinr.), which is recorded from birch, alder and sweet fern in Nova Scotia and also occurs in the United States and Europe.

Mathys (G.). **Contribution à la connaissance de la systématique et de la biologie du genre** *Bryobia* **en Suisse romande.**—*Mitt. schweiz. ent. Ges.* **30** pt. 3 pp. 189–284, 75 figs., 3 pp. refs. Berne, 1957. (With Summaries in German & English.)

In the first part of this paper the author recapitulates his earlier findings as to the occurrence of biological races of *Bryobia praetiosa* Koch on various plants in French Switzerland [*R.A.E.*, A **44** 320], and gives the results of morphological studies from which he concludes that they represent distinct species. The names used are *B. rubrioculus* (Scheuten) for the complex on fruit trees [*cf.* **45** 86 and next abstract], *B. ribis* Thomas for the form on gooseberry [*cf.* **18** 95], *B. kissophila* van Eyndhoven for the one on ivy (*Hedera helix*) [*cf.* **45** 86], *B. cristata* (Dugès) for one that occurs on grass and herbaceous plants, enters houses and is the only one to have adults of both sexes [*cf.* **46** 318], and *B. praetiosa* for a heterogeneous group that also occurs on grass. As the mites on apricot and plum were observed to differ in larval chaetotaxy from those on other fruit trees, the name *B. rubrioculus* form *prunicola*, n., is proposed for them. Four forms of the restricted *B. praetiosa* are referred to as *typica*, *longicornis* Ewing, *macrotibialis*, n., and *longispinum*, n.

The morphology of the various species and forms recognised is discussed at length. There are no differences in the egg, except that the eggs of *B. rubrioculus* and its form *prunicola* are rather smaller than those of the others. The larvae of *B. praetiosa* forms *macrotibialis* and *longicornis* are not known, but those of the other species and forms can be differentiated by differences (sometimes slight) in the dorsal setae. These differences become progressively less in the protonymphs and deutonymphs, and they are of diagnostic value for the adult females only in *B. rubrioculus*, its form *prunicola*, and *B. praetiosa* form *longispinum*. Other characters found of value for separating the adults are the length of the body and of the foreleg, the number of setae on the latter and the length of the setae on the tibia, but complete separation by means of adult characters is not possible and recourse must be had in some cases to larval characters. The characters considered of value in the various developmental stages are illustrated in figures and summarised in tables, and a key to the various species and forms is given, based exclusively on adult females except for *B. rubrioculus*, its form *prunicola*, *B. cristata*, *B. ribis*, *B. kissophila*, and *B. praetiosa* (*typica*), for which final determination depends on the larvae. The male of *B. cristata* is described.

In the second part of the paper, the author reviews in some detail his investigations on the food-plants and annual cycles of the mites in French Switzerland [cf. **44** 320], discusses factors regulating their population increase, notably predacious insects and mites, and makes recommendations for control. The typical *B. rubrioculus* infests mainly apple and pear and rarely stone fruits, whereas *B. rubrioculus* form *prunicola* is closely linked to apricot and plum but also infests apple and pear. Both overwinter in the egg, the former hatching in early April and the latter in late March, and both have several generations a year. Development of a generation of the typical form requires at least 35 days in spring, as compared with 17 in August, and the females lay about 20 eggs each, though their mobility renders observation of the exact numbers difficult. The mites remain in the crowns of the trees, feeding on the leaves and ovipositing on the bark of the branches, show no migratory tendencies and are not caught on adhesive bands placed round the trunks. The males of *B. cristata* are rare and the few observed were found among females sheltering on the walls of houses [*cf.* **44** 320]. Pairing was observed in the laboratory, and the fertilised eggs all gave rise to females. Males of *B. cristata* did not pair with females of *B. rubrioculus*, *B. ribis* or *B. kissophila*.

MORGAN (C. V. G.) & ANDERSON (N. H.). ***Bryobia arborea* n. sp. and morphological Characters distinguishing it from *B. praetiosa* Koch (Acarina: Tetranychidae).**—*Canad. Ent.* **89** no. 11 pp. 485–490, 2 figs., 15 refs. Ottawa, 1957.

Mites of the complex of *Bryobia praetiosa* Koch have proved difficult to classify. Four biotypes were recognised by G. Mathys in Switzerland [*R.A.E.*, A **44** 320; *cf.* also preceding abstract] and two by E. P. Venables in British Columbia, one on deciduous trees, especially fruit trees, and one on herbaceous plants [**31** 364]. It is concluded from morphological studies carried out in the Okanagan Valley of British Columbia since 1952 that the form on herbaceous plants is specifically distinct from the one on deciduous trees, and the name *B. praetiosa* is reserved for it. The name *B. rubrioculus* (Scheuten) has recently been used for most of the *Bryobia* mites found on apple and pear in western Europe [*cf.* **45** 86 and preceding abstract], but as Scheuten's slide material has been lost and recent studies have shown that the other form may also occur on fruit trees, the identity of the species collected by him on pear at Bonn remains uncertain. *B. arborea*, sp.n., is therefore proposed for the mite found exclusively on fruit trees, and the adult female, larva and egg are briefly described. The species is parthenogenetic, no males having been found, and it is recorded from apple at Summerland and Vancouver. Characters distinguishing it from *B. praetiosa* in the egg, larval and adult stages are discussed; the eggs are usually smaller than those of *B. praetiosa*, the larvae are also smaller and show differences in chaetotaxy, and the mature adults are smaller in length, width and depth of body and length of foreleg, irrespective of geographical area, and also show differences in chaetotaxy. A couplet separating the two is given for inclusion in the key in the recent monograph by Pritchard & Baker [**44** 18].

PARADIS (R. O.). **Observations sur les dégâts causés par le charançon de la prune, *Conotrachelus nenuphar* (Hbst.), sur les pommes dans le sud-ouest du Québec.**—*Canad. Ent.* **89** no. 11 pp. 496–502, 1 graph, 8 refs. Ottawa, 1957. (With a Summary in English.)

The following is based on the English summary. Field studies in south-western Quebec in 1955 showed that scars on apples due to feeding by *Conotrachelus nenuphar* (Hbst.) were made by both overwintered and first-generation adults and occurred throughout the growing season. Oviposition scars were made by overwintered adults only and occurred from the time the fruits were set until early August. In the two varieties studied, feeding scars were found in 37·4 and 35 per cent. of the fruits, with a combined average of 36 per cent., and oviposition scars in 62·6 and 65 per cent., with an average of 63·8. The proportions of the two types of damage appeared to be reversed in the insectary, where feeding scars were found on an average of 63·2 per cent. of the fruits of the two varieties and oviposition scars on 36·8 per cent.; 41·1 and 22·1 per cent. of the fruits showed feeding scars made by overwintering and first-generation adults, respectively. It was not possible to estimate these fractions in the field.

On heavily infested trees of one variety growing near woodland areas and lightly infested ones in the same orchard, 70·3 and 56·8 per cent., respectively, of the apples dropped prematurely, the difference being statistically significant. Of the fallen apples, 26·8 per cent. of the former and 3·9 per cent. of the latter showed oviposition scars. A similar comparison of heavily and lightly infested trees of the other variety, which was markedly more resistant to egg and larval development, did not show significance between apples dropped prematurely and those with oviposition scars. Since eggs were laid on both varieties in approximately equal numbers, resistance appears to result from destruction of the eggs by growth of the fruit tissues and failure of the larvae to establish themselves because of tissue hardness.

Wood (G. W.) & Neilson (W. T. A.). **Notes on Life-histories of four Species of Climbing Cutworms collected from low-bush Blueberry Fields in New Brunswick (Lepidoptera: Phalaenidae).**—*Canad. Ent.* **89** no. 11 pp. 502–506, 2 refs. Ottawa, 1957.

The results are given of observations on the bionomics of *Amathes* (*Graphiphora*) *smithii* (Sn.), *A.* (*G.*) *collaris* (G. & R.), *Eucirroedia pampina* (Gn.) and *Heptagrotis phyllophora* (Grote), which feed on low-bush blueberry in New Brunswick and may appreciably reduce the crop, though none is regarded as a serious pest alone, together with descriptions of the eggs and larvae. All these cutworms have one generation a year. *A. smithii*, *A. collaris* and *H. phyllophora* overwinter as larvae in the soil, the first two in the third or fourth instar and *H. phyllophora* in the fifth, whereas *E. pampina* overwinters in the egg stage in litter. Overwintered larvae of *A. smithii* and *A. collaris* and newly hatched larvae of *E. pampina* feed from April till late June or early July, when they pupate in the soil, giving rise to adults between August or, in the case of *A. smithii*, late July, and September. Overwintered larvae of *H. phyllophora* feed from mid-April till about mid-May and adults are present from late June throughout July. Females of *A. smithii* laid a maximum of 411 eggs each, and the egg stage lasted about 12 days in this species and about 18 in *A. collaris*. Parasites reared from field-collected larvae of each species are listed.

Finlayson (L. R.) & Finlayson (T.). **Influence of Adult Food on Viability of early Stages of *Aptesis basizonia* (Grav.) (Hymenoptera: Ichneumonidae), a Parasite of Pine Sawflies (Diprionidae).**—*Canad. Ent.* **89** no. 11 pp. 507–509, 13 refs. Ottawa, 1957.

Aptesis basizona (Grav.), which parasitises the cocoon stages of various Diprionine sawflies in Europe, was introduced into Canada [*cf. R.A.E.*, A **43** 171], but attempts to rear it on a large scale in the laboratory for release there were hampered by the decreasing viability of the eggs and survival of the young larvae with increasing age of the parent female. Experiments showed that ageing females fed on honey laid more eggs on *Neodiprion lecontei* (Fitch) and produced more viable progeny than those fed on raisins. It is suggested that the difference may be due to the presence in honey of some substance similar to vitamin B12.

WISHART (G.), COLHOUN (E. H.) & MONTEITH (A. E.). **Parasites of** *Hylemya* **spp. (Diptera: Anthomyiidae) that attack Cruciferous Crops in Europe.**—*Canad. Ent.* **89** no. 11 pp. 510–517, 24 refs. Ottawa, 1957.

Surveys for parasites and other natural enemies of species of *Hylemyia* that attack cruciferous crops were made in various countries of western Europe during 1949–54, in connection with work on the biological control of *Hylemyia* spp. in Canada [*cf. R.A.E.*, A **47** 88]. Some of the results have already been noticed [*cf.* **42** 367; **43** 434; **45** 483]. The host species chiefly concerned were *H. brassicae* (Bch.), *H. floralis* (Fall.) and *H. cilicrura* (Rond.) which was collected when it occurred on the same food-plants as the other two and which was attacked by the same species. The numbers of puparia of each host species collected throughout the survey, with the percentages of each attacked by the Staphylinids, *Aleochara bilineata* Gylh. and *A. bipustulata* (L.), and the Cynipid, *Trybliographa rapae* (Westw.), the three commonest of the natural enemies, are shown for each year and country in tables. *A. bilineata* was present in almost every country and on all three hosts. Parasitism by *T. rapae* was highest on *H. floralis* in Norway and Finland, where an abundance of *H. brassicae* earlier in the year enables parasite populations to increase [*cf.* **47** 89]. Eight other parasites were also reared, of which the most important were *Phygadeuon trichops* Thoms., recorded from *H. brassicae* in Switzerland, Scotland and Norway [*cf.* **45** 484], *P. fumator* Grav. from *H. brassicae* in France, and *Phygadeuon* sp. from all three hosts in Norway and Finland and *H. brassicae* in Holland. Laboratory-reared adults of *P. trichops* were released in Canada where *Hylemyia* spp. were numerous, but apparently did not become established.

GARMAN (P.). **New Species belonging to the Genera** *Amblyseius* **and** *Amblyseiopsis* **with Keys to** *Amblyseius*, *Amblyseiopsis*, **and** *Phytoseiulus*.—*Ann. ent. Soc. Amer.* **51** no. 1 pp. 69–79, 17 figs., 9 refs. Washington, D.C., 1958.

CHANT (D. A.). **Note on the Status of some Genera in the Family Phytoseiidae (Acarina).**—*Canad. Ent.* **89** no. 11 pp. 528–532, 6 figs., 10 refs. Ottawa, 1957.

The author of the first paper considers *Amblyseius* and *Amblyseiopsis* to be generically distinct from each other [*cf. R.A.E.*, A **41** 158, etc.] and from *Typhlodromus*, gives a key for the separation of these three, *Garmania* and *Phytoseiulus*, and describes two species of *Amblyseius*, one of *Phytoseiulus*, with which he considers *Amblyseiella* to be congeneric, and 16 of *Amblyseiopsis*, of which 11 are new.

The author of the second paper considers that *Amblyseiopsis* and *Amblyseiella* are not distinct from *Amblyseius* and agrees with F. Bernhard that the latter is a subgenus of *Typhlodromus*, differing from the typical subgenus of the latter by the pattern of the lateral setae. *Neoseiulus* [*cf.* **41** 158] is not even subgenerically distinct.

BROWN (N. R.) & CLARK (R. C.). **Studies of Predators of the Balsam Woolly Aphid,** *Adelges piceae* **(Ratz.) (Homoptera: Adelgidae). IV.** *Neoleucopis obscura* **(Hal.) (Diptera: Chamaemyiidae), an introduced Predator in eastern Canada.**—*Canad. Ent.* **89** (1957) no. 12 pp. 533–546, 2 graphs, 1 map, 16 refs. Ottawa, 1958.

In this fourth paper of a series on the predators of *Chermes* (*Adelges*) *piceae* Ratz. on balsam fir (*Abies balsamea*) in eastern Canada [*cf. R.A.E.*, A **47** 69, etc.], details are given of surveys in 1947–50 showing that the introduced *Leucopis* (*Neoleucopis*) *obscura* Hal. had spread considerably in the infested parts of New Brunswick, in which it was released in 1933–36, and Nova Scotia and Prince Edward Island, where it was liberated in 1941 [*cf.* **47** 69]. It was liberated in Newfoundland in 1955–56. In a discussion of the possibility of its having existed in North America prior to the introductions, it is stated that it was not found attacking *C.* (*Pineus*) *strobi* (Htg.) on white pine (*Pinus strobus*) or other possible alternative prey in eastern Canada up to 1956, but that three adults were obtained from an infestation of *C. strobi* in New Brunswick in that year. It appears largely to have replaced the native *L.* (*Leucopina*) *americana* Mall.

Observations on its bionomics showed that it has two generations a year in Canada and overwinters mainly in the pupal stage, but also in the third or even the second larval instar. Adults of the overwintered generation were active from about 20th May until the end of June. Eggs of the first generation were found from 7th June until 15th July, but oviposition probably began earlier. First-instar larvae, which are readily overlooked, were observed between 29th June and 5th July, but were probably present from early June to mid-July, and the larval population reached its peak during the first fortnight of July. Newly formed pupae were present from the end of June to late August, and adults emerged from 3rd July until 12th August. Eggs of the second generation were found from 22nd July to 20th September and were probably present as early as 6th July. The first-instar larvae occurred from 1st August to about 20th September, and the second- and third-instar larvae and newly formed pupae from 6th, 8th and 9th August. The larval population reached its peak in August and early September. The adults of the overwintered and first generations were most active in early June and early August, respectively, when swarms, mostly of females, congregated round heavily infested trees and eggs were laid on the bark.

L. obscura seldom occurred on trees lightly infested with *C. piceae* and became abundant only on very heavily infested ones. Larval populations of both generations increased with increased host numbers, but the increase was relatively small when host densities were high. In rearing experiments, the average prey consumption per larva was 18 adults and 131 eggs. The only parasite of *L. obscura* in Canada is *Pachyneuron altiscutum* How., which attacks the pupae and is also recorded from *L. americana*, *L.* (*Neoleucopis*) *pinicola* Mall., and the introduced *Cremifania nigrocellulata* Czerny. An ant of the genus *Myrmica* was observed feeding on a pupa of *L. obscura*, and various birds probably feed on the overwintering larvae and pupae. Observations during 1947–49 indicated that winter mortality averaged 30 per cent. among the pupae, as compared with only 15 per cent. for *Chermes*.

L. obscura is regarded as of limited importance in the control of *C. piceae* [*cf.* **42** 263], primarily because the larvae are not present early enough to prevent the laying of large numbers of host eggs, it is not effective against low host populations and increases more slowly than its prey and it cannot prevent tree mortality, but it would probably be useful as a member of a more extensive predator complex.

HUDON (M.). *Phryxe vulgaris* **(Fall.) (Diptera: Tachinidae), a new Parasite of** *Pieris rapae* **(L.) (Lepidoptera: Pieridae) in Canada.**—*Canad. Ent.* **89** (1957) no. 12 p. 546, 6 refs. Ottawa, 1958.

A Tachinid subsequently identified as *Phryxe vulgaris* (Fall.) was reared from a pupa of *Pieris rapae* (L.) collected in Quebec in July 1956. This parasite had not previously been recorded from *P. rapae* in Canada, where it was known only from larvae of *Pseudaletia unipuncta* (Haw.) in Nova Scotia and New Brunswick.

Rose (A. H.). **Some Notes on the Biology of** *Monochamus scutellatus* **(Say) (Coleoptera: Cerambycidae).**—*Canad. Ent.* **89** (1957) no. 12 pp. 547–553, 2 graphs, 15 refs. Ottawa, 1958.

The seasonal development of *Monochamus scutellatus* (Say) was studied in a district in north-western Ontario in 1950–56, when this Lamiid became abundant as a result of widespread destruction of balsam fir (*Abies balsamea*) by *Choristoneura fumiferana* (Clem.). Freshly felled logs were set up in the open in the early spring of each year and examined twice a week during the season. The adults usually appeared in June–July and mated 7–10 days later, after which oviposition began almost immediately. Activity was slight when the sky was overcast and greatest on bright days. Many more eggs were laid on the side and lower surface than on the upper surface of logs in full light, but few were laid on logs in full shade. About 70 per cent. of the slits made in the bark by the ovipositing females did not contain eggs. The slits were most abundant in wrinkled bark surrounding branches or old branch scars and near other scars, and those containing eggs were almost invariably cut in cavities that appeared to be empty resin blisters. Oviposition continued over 7–10 weeks, but 90 per cent. of the eggs were laid in 4–6 weeks. The dates of the beginning and the completion of 50 per cent. of oviposition varied, respectively, from 6th June in 1952 to 10th July in 1950 and from 29th June in 1955 to 28th July in 1950. Oviposition ceased in the first week in September. The larvae, which had four instars, hatched in 9–14 days, tunnelled to the cambium, which they reached in 2–3 days, and fed there in shallow mines during the first two instars, each of which lasted 2–3 weeks. Where the larvae were numerous, the mines coalesced and cannibalism occurred. By early September, most of the larvae were in the third instar. They still fed at the surfaces of the wood and phloem, but soon began tunnelling into the wood, and continued to do so until the onset of continuous cold weather. The third-instar larvae and a few that had reached the fourth instar overwintered in tunnels extending deep into the wood; a few still in the second instar constructed shallow tunnels in the wood, in which they overwintered. Activity was resumed with the first warm weather, and larvae that had overwintered in the fourth instar pupated and gave rise to adults. By mid-summer most of the others were tunnelling back towards the surface, and by mid-August most had reached the fourth instar and were within 5 mm. of the surface of the wood. Here cells were constructed in which the second winter was passed, in the prepupal stage. Pupation occurred early in the third season and the adults emerged after about two weeks. Adult emergence extended over 6–9 weeks and began as early as the end of May in 1955 and as late as mid-June in 1951; there was usually a peak during the last three weeks of June.

Observations in 1952–54 showed that adults were produced from less than 2 per cent. of the eggs. Mortality was highest during the egg stage and among the young larvae and was attributed to desiccation of the eggs through exposure to the sun and to cannibalism, respectively. Only 12 per cent. of the total mortality occurred after the larvae had entered the wood, and evidence was obtained that most of this was caused by woodpeckers. Death due to disease or parasites was rare.

Harcourt (D. G.). **Biology of the Diamondback Moth,** *Plutella maculipennis* **(Curt.) (Lepidoptera: Plutellidae), in eastern Ontario. I. Distribution, economic History, Synonymy, and general Descriptions.**—*37th Rep. Quebec Soc. Prot. Pl. 1955* pp. 155–160, 1 pl., 21 refs. Quebec, 1956. **II. Life-history, Behaviour, and Host Relationships.**—*Canad. Ent.* **89** (1957) no. 12 pp. 554–564, 2 figs., 17 refs. Ottawa, 1958.

Plutella maculipennis (Curt.) was recently found to be of more importance than previously thought as a pest of cabbage and other cruciferous crops in eastern Ontario [*cf. R.A.E.*, A **45** 228]. Its distribution, economic history and synonymy are reviewed and all stages briefly described in the first part of this paper. Studies on some aspects of its bionomics made near Ontario in 1951–56 are recorded in the second part, and the following is largely the author's summary of the results. The adults rest on the food-plants during the day and become active just before dusk, reaching peak activity well before midnight. Mating occurs on the day of emergence. Females caged out of doors laid 18–356 eggs each, with an average of 159. Egg-laying lasted about ten days, the peak occurring on the first night, except when the temperature at sunset was below 66°F. In the field, the number of eggs laid on individual cabbage plants ranged from 0 to 164. About 50 per cent. more eggs were laid on the upper surfaces of the leaves than on the lower; few were laid on the stems and leaf petioles. Almost as many eggs were laid in small groups as were laid singly. In a field cage, the incubation period for 2,236 eggs averaged 5·6 days. The larvae feed from the lower leaf surface, consuming all the tissues except the veins and the upper epidermis. First-instar larvae, however, mine the leaf, feeding in the spongy mesophyll layer. For 2,022 larvae, the average duration of the instars in days was 4·5 for the first, 4 for the second, 4·1 for the third, and 4·9 for the fourth. Pupation normally occurs on the food-plant. The prepupal period lasted 1–2 days; for 2,000 individuals the duration of the pupal stage was 5–15 days, the average being 8·5. The sexes were equally numerous. The life-span of 101 females averaged 16·2 days and that of 105 males 12·1 days. There were 4–6 generations per year. The first generation developed mainly on cruciferous weeds, and subsequent ones on cruciferous crops. The insect apparently does not overwinter at Ottawa, infestation being due to moths migrating from the south. Studies with a controlled-interval light-trap showed that the moth was in flight for an average of 136 days each year, that the heaviest period of flight was from late July to early September, and that peak flight occurred during the hour beginning 90 minutes after sunset. *Barbarea vulgaris* is a preferred wild food-plant, but little preference was shown between seven commonly cultivated cruciferous crops.

PUTMAN (W. L.). **Laboratory Studies on the Food of some Coccinellids (Coleoptera) found in Ontario Peach Orchards.**—*Canad. Ent.* **89** (1957) no. 12 pp. 572–579, 6 refs. Ottawa, 1958.

Feeding by Coccinellids on insects and mites of economic importance in peach orchards in the Niagara Peninsula of Ontario was investigated in the laboratory, mostly during June and July in 1952–55, in connection with studies on the effects of spray treatments on agents of natural control [*cf. R.A.E.*, A **45** 6]. The following is based on the author's summary of the results. Adults of *Ceratomegilla* (*Coleomegilla*) *maculata lengi* (Timb.) fed readily on *Tetranychus telarius* (L.) and the larvae developed normally on the same prey; this species also readily attacked *Panonychus* (*Metatetranychus*) *ulmi* (Koch), the eggs of *Cydia* (*Grapholitha*) *molesta* (Busck), and, to a less extent, the crawlers of *Pulvinaria vitis* (L.). Adults of *Hippodamia convergens* (Guér.), *H. tredecimpunctata tibialis* (Say), *Adalia bipunctata* (L.), *Coccinella transversoguttata* Fald., *C. trifasciata perplexa* Muls. and *Cycloneda sanguinca* (L.), in limited tests, either refused these species or ate only small numbers after being deprived of food. Larvae of the same species and of *Anatis quinquedecimpunctata* (Deg.) did not develop normally on *T. telarius*. The food preferences of the larvae were generally similar to those of adults of the same species. All the Coccinellids concerned feed primarily on aphids, except *Ceratomegilla*, which is more or less polyphagous.

Cass (L. M.). **A Dispersal of Larvae of the Colorado Potato Beetle,** *Leptinotarsa decemlineata* **(Say) (Coleoptera: Chrysomelidae).**—*Canad. Ent.* **89** (1957) no. 12 pp. 581–582, 2 refs. Ottawa, 1958.

During studies on *Leptinotarsa decemlineata* (Say) in Ontario in 1952, the plants in a plot of early potatoes that had been artificially infested with overwintered adults on 30th June were defoliated by the resultant larvae by 14th July. Two days later, when the air temperature averaged 74·2°F. and there was a west wind, almost all the larvae left the plants, 58 per cent. of them migrating westward towards another potato field 350 ft. distant. The farthest distances travelled were 50, 100 and 250 ft. by larvae in the second, third and fourth instars, respectively, and 30, 29 and 17 per cent. of the larvae travelled 5, 10 and 20 ft., respectively. A few larvae fed, but not extensively, on *Polygonum convolvulus*, *Chenopodium album* and *Amarantus retroflexus*.

Davey (K. G.) & Manson (G. F.). **Chemical Control of Insects attacking Alfalfa in southwestern Ontario.**—*Canad. J. Pl. Sci.* **38** no. 1 pp. 34–38, 10 refs. Ottawa, 1958.

The following is based partly on the authors' abstract. Surveys in lucerne fields in south-western Ontario in 1953 and 1954 showed that several species of Hemiptera were sufficiently abundant to be of economic importance. These comprised *Philaenus leucophthalmus* (L.), of which 2–3 nymphs were present per stem in May and June and adults were later numerous, *Macrosiphum pisum* (Harris) (*Acyrthosiphon pisi* (Kalt.)), which was numerous in some fields, *Empoasca fabae* (Harris), which was present from early June until autumn, and *Lygus* (*Liocoris*) spp., notably *L. lineolaris* (P. de B.), which was numerous from May till September. The initial small numbers of these insects present in early spring tended to increase rapidly as the season progressed. Each time the hay was cut, their numbers were reduced, but invading populations soon increased, often to economic proportions. Sprays of wettable malathion, Perthane [1,1-bis(p-ethylphenyl)-2,2-dichloroethane (ethyl-DDD)], toxaphene and heptachlor applied on 19th May 1954 at 0·5, 1, 1·25 and 0·38 lb. in 50 gal. water per acre, respectively, prevented the usual build-up of nymphs of *P. leucophthalmus*; malathion reduced the numbers of *M. pisum* for about ten days, and all the insecticides, especially toxaphene and heptachlor, those of *Lygus* for two weeks. The use of any of the insecticides except heptachlor, which preliminary tests in the laboratory indicated may exert a phytotoxic effect on lucerne, was followed by increased yields from the first cutting of hay. Treatment on 9th July, after the first cutting, and on 11th August, after the second, did not give adequate insect control or result in increased yields, though malathion and ethyl-DDD had some effect on *Empoasca*, which was not present earlier.

Downing (R. S.). **Recent Trials with new Acaricides in British Columbia Orchards.**—*Canad. J. Pl. Sci.* **38** no. 1 pp. 61–66, 8 refs. Ottawa, 1958.

Apple trees in British Columbia are infested by *Panonychus* (*Metatetranychus*) *ulmi* (Koch) and also by a species of *Bryobia* recently described as *B. arborea* by Morgan & Anderson [*cf. R.A.E.*, A **47** 118]. An account is given of experiments on their control carried out since about 1950 to compare various acaricides applied in sprays at the pink-bud stage or in summer, and the following is based partly on the author's abstract of it. Sprays were applied, unless otherwise stated, at 75 gal. per acre by air-blast machine, and good control of both mites was given by pink-bud applications affording, per acre, 2 lb. 50 per cent. wettable chlorfenson (p-chlorophenyl p-chlorobenzenesulphonate) or fenson (p-chlorophenyl benzenesulphonate) or 20 per cent. wettable chlorbenside (p-chlorobenzyl p-chlorophenyl sulphide), 1 gal. 50 per cent. emulsifiable Genite 923 (2,4-dichlorophenyl benzenesulphonate) or 8 lb. 18·5 per cent. Kelthane (1,1-bis(p-chlorophenyl)-2,2,2-trichloroethanol); in similar sprays, 8 lb. 25 per cent. wettable chlorobenzilate (ethyl 4,4′-dichlorobenzilate) per acre or 1 gal. per acre of an emulsion spray concentrate containing 4 lb. Trithion (O,O-diethyl S-p-chlorophenylthiomethyl phosphorodithioate) per U.S. gal. gave good control of *P. ulmi*, but were not tested at the pink-bud stage against *Bryobia*. Trithion gave good initial and residual control of both mites when applied in summer, and one of Kelthane applied by hand-gun sprayer was similarly effective against *Bryobia*; wettable diazinon (O,O-diethyl O-2-isopropyl-4-methyl-6-pyrimidinyl phosphorothioate) gave fair initial control of both but lacked residual effectiveness. Chlorobenzilate gave good control of *Bryobia*, but was not tested against *P. ulmi* in summer. Chlorfenson and chlorbenside injured apple foliage when applied at the pink-bud stage. Summer applications of these materials or of fenson injured the fruits of some varieties, and Genite severely injured apple foliage when applied in summer.

Pond (D. D.) & Chisholm (D.). **Influence of Weathering on DDT Coverage in a Potato Spray Program.**—*Canad. J. Pl. Sci.* **38** no. 1 pp. 81–83, 5 refs. Ottawa, 1958.

The following is based partly on the authors' abstract of this account of investigations in 1953 and 1954 in New Brunswick on the persistence of spray deposits on potato foliage. Sprays of 5 lb. 20 per cent. DDT emulsion concentrate per 100 gal. were applied in July and August, and it was found that plants in the field lost 26–63 per cent. of the initial deposits within 24 hours of application, whereas comparable plants transferred to the greenhouse lost significantly less. There was no significant difference between the deposits on leaves from the top, middle and bottom of the plant, and leaf development is therefore thought to have little effect on persistence, which is affected mainly by weathering. The results indicate that leaf samples taken shortly after spraying should provide satisfactory data for the evaluation of DDT applied for immediate effect, but that an interval of at least two days should elapse if its value as a protectant is being assessed.

Morgan (C. V. G.), Anderson (N. H.) & Swales (J. E.). **Influences of some Fungicides on Orchard Mites in British Columbia.**—*Canad. J. Pl. Sci.* **38** no. 1 pp. 94–105, 27 refs. Ottawa, 1958.

Increased incidence of apple scab (*Venturia inaequalis*) in orchards in British Columbia in recent years has resulted in the wider use of fungicides on apple, and an account is here given of investigations during 1951–55 of the effects of sprays containing them on orchard mites present on the trees. The following is based on the authors' summary of the results. A single spray of lime-sulphur at the pink-bud stage was effective against *Panonychus* (*Metatetranychus*) *ulmi* (Koch) for only two months, but a schedule of 4–7 applications gave excellent control of this mite and *Eotetranychus carpini borealis* (Ewing) for the entire season. Three summer sprays of sulphur did not affect *P. ulmi*, but controlled *Tetranychus telarius* (L.) and *Vasates schlechtendali* (Nal.). A schedule of 4–7 sprays of ferbam (ferric dimethyldithiocarbamate) gave good control of *E. c. borealis*, but the use of captan

(N-(trichloromethylthio)-4-cyclohexene-1,2-dicarboximide) in similar schedules was followed by increased numbers of both this mite and *P. ulmi*; the latter also increased after five applications of ziram (zinc dimethyldithiocarbamate). Glyodin (2-heptadecyl-2-imidazoline acetate) did not control any species, and sometimes resulted in increases in *P. ulmi* and *E. c. borealis*. A schedule of 4–7 applications of maneb (manganese ethylenebisdithiocarbamate) controlled *P. ulmi* and *V. schlechtendali* and delayed the peaks in population of *T. telarius* and *E. c. borealis*, but allowed large numbers of the species of *Bryobia* described as *B. arborea* by Morgan & Anderson [*R.A.E.*, A **47** 118] to build up. Manam (manganese dimethyldithiocarbamate) applied seven times compared favourably with maneb against *P. ulmi* and *T. telarius*. One spray of Karathane (2,4-dinitro-6-(1-methylheptyl)phenyl crotonate) controlled all the mites, including also *Tetranychus mcdanieli* McG., if the application was timed correctly. Four applications of Orthorix (calcium polysulphides and polyethylene glycol monoisooctyl phenylether) were very effective against *P. ulmi*, and a summer spray of nabam (disodium ethylenebisdithiocarbamate) gave 56·3 per cent. mortality, but three or more applications of Nirit (2,4-dinitrophenyl thiocyanate), dichlone (2,3-dichloro-1,4-naphthoquinone) or zineb (zinc ethylenebisdithiocarbamate) were of no value.

Among predacious mites, species of *Typhlodromus*, principally *T. occidentalis* Nesbitt and *T. fallacis* (Garman), were not affected by glyodin, but were reduced in numbers by ziram and almost eliminated by maneb and Karathane. *Mediolata* sp. was only slightly reduced in numbers by glyodin, but maneb was somewhat more toxic to it and Karathane eliminated it. One application of Karathane caused 27 per cent. mortality of the predacious Coccinellid, *Stethorus picipes* Csy.

PROVERBS (M. D.). **Control of Soft Scales (Homoptera: Coccidae) in British Columbia Peach and Apricot Orchards.**—*Proc. ent. Soc. B.C.* **54** pp. 3–8. Vernon, B.C., 1957.

Peach and apricot in the Okanagan Valley of British Columbia have in recent years been increasingly attacked by soft scales. The chief species concerned are *Pulvinaria* sp., which is most frequent on peach, and two undetermined species of *Eulecanium* (*Lecanium*) referred to as sp. A and sp. D, of which the first prefers apricot and the second is confined to peach. Both species of *Eulecanium* overwinter as small nymphs and develop rapidly during April and May. The females begin ovipositing in early June, and the nymphs hatch during June and July and feed on the leaves until these are about to fall, when they migrate to branches 1–3 years old, on which they overwinter. The life-cycle of *Pulvinaria* sp. is similar, but oviposition starts about two weeks earlier, hatching begins about mid-June, and many of the nymphs migrate to small branches during the summer and are almost half-grown by autumn. At least five species of Hymenopterous parasites were reared from these Coccids, which were also preyed on by the larvae of *Leucopis* sp.; in addition, Coccinellids, Anthocorids and birds fed on *Eulecanium* spp.

Field experiments on control by means of sprays were carried out in 1949–55, and the following is based on the author's summary of the results. A post-harvest spray of 25 per cent. wettable malathion or diazinon (O,O-diethyl O-2-isopropyl-4-methyl-6-pyrimidinyl phosphorothioate), both at 2 lb. per 100 gal., or a 25 per cent. Trithion concentrate (containing 4 lb. O,O-diethyl S-p-chlorophenylthiomethyl phosphorodithioate per U.S. gal.) at 1 pint per 100 gal. gave excellent control of summer nymphs of the first species of *Eulecanium* on apricot, but one of nicotine sulphate destroyed only the nymphs that were exposed. The diazinon and malathion sprays applied to peach at the pink-bud stage gave good control of small overwintered nymphs of the other species of *Eulecanium*, but were not quite so effective against slightly larger nymphs of either. Parathion, γ BHC as lindane, nicotine sulphate and demeton (diethyl 2-(ethylthio)ethyl phosphorothioate) were unsatisfactory when applied to apricot at the calyx stage or in the summer. Summer nymphs of *Pulvinaria* on peach were controlled in June, when about 75 per cent. of the eggs had hatched, by a spray of 15 per cent. parathion at 0·75 lb. per 100 gal., but one of nicotine sulphate with soap was rather less effective owing to its lack of persistence; both γ BHC and toxaphene were ineffective, as also were various treatments applied against other stages.

FULTON (H. G.). **Soil Insecticides for Control of the Tuber Flea Beetle,** *Epitrix tuberis* **Gent., in the Lower Fraser Valley of British Columbia.** —*Proc. ent. Soc. B.C.* **54** pp. 14–16. Vernon, B.C., 1957.

Experiments on the control of *Epitrix tuberis* Gentner on potato were carried out during 1947–55 on loam and silt soils at two places in the Lower Fraser Valley of British Columbia. DDT applied to the foliage alone or with calcium arsenate was previously shown to reduce damage by destroying the adults [*cf. R.A.E.*, A **35** 44; **37** 269], but sometimes failed if not applied early, frequently or thoroughly enough or if weather conditions were unfavourable. Tuber damage was shown in 1944 not to be proportional to the number of adults present, and, subsequently, calcium arsenate and cryolite applied to the soil were found to be ineffective against the larvae, which were best controlled by a dust of DDT and calcium arsenate applied to the foliage. In the work begun in 1947, further soil treatments were tested. Single applications of dusts of chlordane, aldrin, dieldrin or heptachlor broadcast over the soil and lightly raked in before planting gave complete or almost complete control of the larvae, and the minimum effective rates were found in 1955 to be 5, 2, 1 and 2 lb. toxicant per acre, respectively. BHC and γ BHC as lindane applied to the soil were also effective but damaged the plants and tainted the tubers. Better results were obtained when the insecticides were applied broadcast than when they were applied in bands 6, 12 or 14 in. wide; the depth to which they were incorporated appeared not to influence the results. Heptachlor was considerably less effective in granules than as a dust applied at the same rate, but the carrier was subsequently found to have contributed to rapid loss of toxicity; aldrin was slighly less effective in granules than in a dust. A single application of DDT to the soil and four applications of sprays containing DDT or methoxy-DDT (methoxychlor) to the leaves were of no value. Provided that the soil is in good tilth, soil treatment is simpler and more reliable than are sprays applied to the leaves, but an advantage of the latter is that they can be combined with fungicidal treatments.

DOWNING (R. S.). **Chemical Control of the Brown Mite,** *Bryobia arborea* **M. & A., and of the Clover Mite,** *B. praetiosa* **Koch, in British Columbia.** —*Proc. ent. Soc. B.C.* **54** pp. 19–20, 3 refs. Vernon, B.C., 1957.

The name *Bryobia arborea* has been proposed by Morgan & Anderson for the form of *B. praetiosa* Koch that infests fruit trees in British Columbia, *B. practiosa* being reserved for the form that infests herbaceous plants and sometimes migrates into houses [*cf. R.A.E.*, A **47** 118]. The information here given on the control of the first of these mites has already been noticed from a more detailed source [**47** 124]. In experiments on the control of *B. praetiosa* in houses, a wettable-sulphur dust applied to the soil round the foundations in May 1955 was of no value, and sprays of 25 per cent. malathion or 92 per cent. wettable sulphur, both at 2 lb. per 100 gal., applied to the walls of a house, the soil round it, and plants in the garden were also ineffective, but a spray of 18·5 per cent. 1,1-bis(p-chlorophenyl)-2,2,2-trichloroethanol (Kelthane) applied at 2 lb. per 100 gal. gave satisfactory control. In a laboratory test in May 1956, only 8 per cent. of some 30 mites survived exposure for two days on filter paper that had been dipped into a suspension of Kelthane at the same concentration, whereas the survival percentages on paper treated with 40 per cent. p-chlorophenyl phenyl sulphone at 4 lb. per 100 gal. and on untreated paper were 31 and 87, respectively. When the two acaricides were sprayed on to the outside walls of a heavily infested house, the soil round them, and the lawn for a distance of 8 ft. from the house, the sulphone was only fairly effective, but Kelthane gave excellent and persistent control.

FORBES (A. R.) & FINLAYSON (D. G.). **Species of Root Maggots (Diptera: Anthomyiidae) of Cruciferous Crops in British Columbia.**—*Proc. ent. Soc. B.C.* **54** pp. 25–28, 8 refs. Vernon, B.C., 1957.

The following is substantially the authors' summary. Root maggots collected in 1949–56 from cruciferous crops, chiefly swedes, in British Columbia consisted mostly of *Hylemyia brassicae* (Bch.). *H. cilicrura* (Rond.) occurred frequently and *H. floralis* (Fall.) was found only during August and September at three places [*cf. R.A.E.*, A **43** 240]. *H. fugax* (Mg.) was collected in small numbers, and a single adult of *H. planipalpis* (Stein) was reared from a larva collected from swede. *H. trichodactyla* (Rond.) (*liturata* (Mg.)) was not found on cruciferous crops, but was observed on bean roots at Vancouver. *H. brassicae* and *H. floralis* caused primary root damage. On swedes, *H. cilicrura* occurred only in association with *H. brassicae* or *H. floralis* or both.

SPENCER (G. J.) & BUCKELL (E. R.). **On the Acridiophagous Sarcophagidae of British Columbia with Records of all Others taken in the Province.**—*Proc. ent. Soc. B.C.* **54** pp. 29–36, 8 refs. Vernon, B.C., 1957.

The authors give a list of the 54 species and varieties of Sarcophagids recorded from British Columbia, and another of the 14 reared there from grasshoppers caught in the field, and describe observations and investigations on the habits of the latter [*cf. R.A.E.*, A **35** 59]. The principal grasshoppers of the Province are *Melanoplus bilituratus* (Wlk.), which is widespread though it becomes of serious importance only every 7–9 years, and *Camnula pellucida* (Scud.), which is even more widely distributed. *M. bilituratus* has for long been misidentified as *M. mexicanus* (Sauss.) [*cf.* **13** 195] [which has been found by A. B. Gurney & A. R. Brooks to be largely restricted to Mexico]. The Sarcophagids occur sporadically, and all principally attack *M. bilituratus*, the maximum parasitism recorded in *C. pellucida* being only 6 per cent. The parasite adults rest on objects raised slightly above ground level and in field tests greatly preferred white sacks to brown or dirty ones. They pursued small moving objects, not necessarily insects, and parasitism was increased by any factor, such as the presence of grazing sheep, that caused the grasshoppers to jump or fly. Nymphs in the fourth and fifth instars were attacked as well as adults. When grasshoppers were numerous, the visual stimuli provided by them sometimes succeeded each other too rapidly to permit the parasite females to larviposit. Larvae were not found on the bodies of grasshoppers examined immediately after attack, but they may be deposited on the wings, which were not examined. When expressed first-instar larvae of *Sarcophaga aculeata* Aldr., *S. reversa* Aldr., *S. kellyi* Aldr., *S. opifera* Coq. (the most abundant parasite), *S. l'herminieri* (R.-D.) (which is widespread and common) and three varieties of another species were placed on various parts of immobilised hosts of either species in the laboratory, they were able to penetrate only through the tympanum, but then developed normally. Many larvae were introduced into wounds in the bodies of hosts, but of 100 larvae of *S. reversa* introduced into *C. pellucida*, none became established. Larvae of *S. l'herminieri* were repelled by the body fluid of a grasshopper and quickly came out when introduced into its body cavity, but developed normally on fresh rabbit intestine. Up to nine parasite larvae of small species, such as *S.* (*Helicobia*) *rapax* Wlk., which was dominant in 1931, and *S. opifera* may occur in one host, but only one of the larger species. The larvae of the small species appear to feed principally on the body fluid, as a result of which the fat-body diminishes and the reproductive organs fail to develop; the fat-body may later be consumed. Larvae of larger species, such as *Sarcophaga* (*Blaesoxiphotheca*) *coloradensis* Aldr., which was common in 1954, when most others were absent, consume the entire body contents. *S. kellyi*, which has at times successfully controlled outbreaks of *M. bilituratus*, was the only species that could be reared in the laboratory from expressed first-instar larvae. Immobilised or partly crushed beheaded grasshoppers were provided every 1–2 days as food, and the pupae could be stored over the winter.

FULTON (H. G.). **Unusual Damage to Potatoes by the Two-spotted Spider Mite,** *Tetranychus telarius* **(L.), in the Lower Fraser Valley.**—*Proc. ent. Soc. B.C.* **54** p. 44, 3 refs. Vernon, B.C., 1957.

Infestation by *Tetranychus telarius* (L.) caused the foliage of late potatoes in a field in British Columbia to turn brown and die off in early July 1956, and the damage was particularly severe near the edge adjoining a hedgerow. Similar infestations were later reported on potato at two other places, and large populations of the mite also occurred on sweet maize, pole beans and marigolds. The summer was in general hot and dry, though not exceptionally so, and the widespread use of DDT against the tuber flea-beetle [*Epitrix tuberis* Gentner] may have contributed towards the population increase. *T. telarius* has not previously caused damage to potato in British Columbia, though it is known to attack this crop in Washington and Idaho.

KINGHORN (J. M.) & CHAPMAN (J. A.). **The Effect of Douglas-fir Log Age on Attack by the Ambrosia Beetle,** *Trypodendron lineatum* **(Oliv.).**—*Proc. ent. Soc. B.C.* **54** pp. 46–49, 1 graph, 7 refs. Vernon, B.C., 1957.

Adults of *Trypodendron lineatum* (Ol.) appear in early spring, but attack trees felled during the preceding autumn and winter rather than more recently felled ones; the relation of intensity of attack to the period after felling was investigated in British Columbia during 1956. Two Douglas firs [*Pseudotsuga menziesii*] felled on 7th February were each cut into 24 18-in. blocks, consisting of six groups of four adjacent blocks, and series of six blocks, one from each group, were given treatments. Two series of blocks from each tree had the cut ends covered with wax, after which the blocks in one series from each tree were aged at 72°F. for 2–12 weeks and then transferred to 0°F. and those in the other were kept as controls by storing in plastic bags at 0°F. One of the remaining two series from one of the trees was not waxed, and one of those from the other tree was waxed after the blocks had been autoclaved at 20 lb. pressure for two hours to arrest cellular or enzyme activity in the sapwood and so maintain starch reserves. These were aged and control series set up as before. On 17th May, all the blocks were placed in a partly shaded clearing near a recently felled area, where subsequent attack by *Trypodendron* was heavy. After exposure for six days, only six entries were recorded, of which only one was in aged wood, but by 29th November there were 155, of which 27 were in aged wood, and by 16th July, when the bark was removed and the experiment terminated, there was a mean of about 10 entry holes per sq. ft. on all the aged blocks except those that had been autoclaved and about 30 per sq. ft. on the controls; the mean number per sq. ft. in the autoclaved blocks was 1·5 in aged wood and about 14 in the controls. The attractiveness of the waxed aged blocks from the first tree declined steadily as the period of ageing increased, but blocks in the unwaxed series from this tree and the waxed aged series from the other showed no further decline after ageing for more than six weeks.

It is concluded that some change took place in the blocks after they were set out and before they were attacked, that neither the wax coating nor difference between the individual trees greatly influenced the intensity of attack, but that ageing and autoclaving prevented the formation of some attractive substance or depleted it. The reduced attack on the unautoclaved aged blocks, as compared with their controls, might have been due to continued cellular activity, since conditions during ageing were similar to those described in a paper already noticed [*R.A.E.*, A **22** 542], in which the living cells were shown to deplete the starch reserves, though in the present work iodine tests at the time of felling and after ageing failed to demonstrate the presence of starch.

SEKHAR (P. S.). **Studies on** *Asaphes fletcheri* (**Crawford**), **a Hyperparasite of** *Aphidius testaceipes* (**Cresson**) **and** *Praon aguti* (**Smith**), **primary Parasites of Aphids.**—*Ann. ent. Soc. Amer.* **51** no. 1 pp. 1–7, 1 graph, 8 refs. Washington, D.C., 1958.

In the summer of 1954, high mortality of test populations of *Aphidius testaceipes* (Cress.), a parasite of aphids, was caused in a greenhouse in Massachusetts by the Pteromalid, *Asaphes fletcheri* (Crwf.), of which D. B. Burks considers *A. americanus* Gir. [*cf. R.A.E.*, A **18** 74] to be a synonym. Further observations showed that it also attacks *Praon aguti* Smith, another Braconid parasite of aphids, and investigations on the habits of the hyperparasite were therefore made. It was reared in the laboratory at temperatures of 23–30°C. [73·4–86°F.] by allowing females to oviposit in *Aphidius* or *Praon* in aphid hosts, and the following is based on the author's summary of the results. Fertilised females produced mostly female progeny, and unmated ones males only. When hosts were provided for two hours per day, the oviposition period ranged from two to 13 days. Most attacks occurred on the first day and at a temperature of 28°C. [82·4°F.]. The life-cycle from egg to adult required up to 27 days at 23°C. and a saturation deficiency of 3 mm. and up to about 10 days at 30°C. and a saturation deficiency of 8 mm. Males developed more rapidly than females, but the latter had longer adult lives. Only dead sessile parasitised aphids were chosen for attack. The early pupae of *Aphidius* were preferred to the late larvae and the late larvae of *Praon* to the pupae; no other stages were attacked, and parasitism of *Aphidius* was greater than that of *Praon*. In the field, an increase in the population of *Asaphes* resulted in a marked scarcity of *Aphidius*, especially in one locality in which both Braconids were present.

HOWDEN (H. F.) & AUERBACH (S. I.). **Some Effects of Gamma Radiation on** *Trogoderma sternale* **Jayne.**—*Ann. ent. Soc. Amer.* **51** no. 1 pp. 48–51, 3 graphs, 9 refs. Washington, D.C., 1958.

The insects used in the tests recorded belonged to a strain of *Trogoderma sternale* Jayne found in crushed maize in Tennessee. Isolated pairs of adults produced up to 62 eggs per female, whereas the average was 27 in controls containing several females at one time. The larvae hatched in about a week, moulted 7–15 times and mostly gave rise to adults in 5–6 months, though a few did not do so for 9–12 months. The experiments were carried out with larvae that had reached at least the fifth instar, and they were transferred in batches of 50 to 4-oz. jars containing 20 g. pulverised Purina chow, 1·5 g. dried pulverised insects and 5–6 pieces of paper towelling 1 in. square. Radioactive cobalt (^{60}Co) was used as the source of γ-rays, and the doses comprised 1,000–10,000 roentgens delivered at the rate of 19 r. per sec. One series received the doses in single exposures, and the other in equal parts on five successive days. The larvae and the food substrate were transferred to a polyethylene cylinder for treatment and then returned to the jars, kept at 29°C. [84·2°F.] and inspected weekly. All adults that appeared were transferred to fresh jars containing the same food mixture, and this was examined periodically for larvae. The following is taken from the authors' summary of the results.

All doses applied to the larvae adversely affected the reproduction of the resulting adults, but the reduction in population caused by exposure to 4,000 r. or less may have been due to lowered vitality or morphological deformity. Continuous exposure to 5,000 r. and above inhibited reproduction, but when the dose was divided, the threshold for inhibition was 6,000 r. At the lower levels, dividing the dose had no effect. Larval development was delayed more by continuous than by divided doses.

Davis (G. R. F.). **Note on Survival and Feeding of newly hatched Larvae of** *Ctenicera aeripennis destructor* **(Brown) (Coleoptera: Elateridae).**—*Ann. ent. Soc. Amer.* **51** no. 1 pp. 51–52, 2 refs. Washington, D.C., 1958.

Davis (G. R. F.). **Growth and Feeding Behavior of Larvae of** *Ctenicera aeripennis destructor* **(Brown) (Coleoptera: Elateridae). II. Effects of sterilized Flax Seed and sterilized Soil.**—*T. c.* no. 2 pp. 164–167, 4 refs.

In the tests described in the first of these papers, newly hatched larvae of *Ctenicera aeripennis destructor* (Brown) were transferred individually to 1-oz. salve tins containing moistened soil alone or with one seed of wheat, barley or rye or five seeds of flax, kept at 68°F. and 75 per cent. relative humidity and examined fortnightly, when fresh soil and food were provided, for 12 weeks. Survival on rye or barley was not significantly higher than on no food, and significantly more larvae survived on flax than on rye or barley, but not on wheat. Mortality was greatest during the first fortnight and continued at a high level for six weeks; it was complete after the first fortnight in soil alone, whether this had been sterilised or not. The larvae fed as often on one food as on any other [*cf. R.A.E.*, A **47** 91], the periods of greatest feeding varying with the type of food. The results suggest that flax is as good a food for the larvae as wheat and better than rye or barley [*cf.* **27** 540].

The second paper is one of a series [*cf.* **47** 90], and the following is virtually the author's summary of it. Medium-sized and large larvae of *C. a. destructor* were reared during a 30-week period in unsterilised and in sterilised soil with unsterilised or sterilised flax seed, or without food. Medium-sized larvae fed less on sterilised than on unsterilised flax and gained most weight on it. Large larvae fed less on sterilised flax in sterilised soil than on unsterilised flax in sterilised soil. In terms of gain in weight, they were not affected by sterilisation of flax or soil alone, but they gained most weight when sterilised flax was provided in sterilised soil. Larvae with food moulted and survived equally well in unsterilised and in sterilised soil. They also lost equal amounts of weight. It is suggested that sterilising flax increased the nutritional value of the seed for medium-sized larvae. Sterilising the soil removed neither nutritional nor deleterious factors from the diet of the larvae. However, sterilising both the flax seed and the soil increased the development rate of larvae of this species. The results of this study indicated that there may be some nutritional difference between larvae of different size groups.

Messenger (P. S.) & Flitters (N. E.). **Effect of constant Temperature Environments on the Egg Stage of three Species of Hawaiian Fruit Flies.**—*Ann. ent. Soc. Amer.* **51** no. 2 pp. 109–119, 2 graphs, 57 refs. Washington, D.C., 1958.

To facilitate the analysis and evaluation of data derived from an intensive bioclimatic study of *Dacus dorsalis* Hend., *D. cucurbitae* Coq. and *Ceratitis capitata* (Wied.) in Hawaii [*cf. R.A.E.*, A **42** 8], information was required on the effects of constant temperatures on the duration of the different stages of these fruit-flies. Studies were carried out on the effects of both constant and regularly fluctuating temperatures, and the results obtained when the eggs were subjected to constant temperatures are here recorded. The temperatures used ranged from about 52 to about 98°F., and the eggs were kept in a saturated environment.

The following is virtually the authors' summary of the results. At any given temperature, there were individual variations in rate of growth among eggs, and hatching proceeded according to a skewed distribution that could be normalised by a logarithmic transformation. Because of this, developmental periods were computed from the medians rather than from the arithmetic mean of the hatching periods. The variations in growth rate were greater at high and low temperatures than at medium temperatures.

The relation between growth rate and temperature was sigmoidal rather than rectilinear, with an actual decrease in rate at high temperatures. The shape of the growth-rate curve approximated the empirical Shelford curve, and may be rather closely approximated by an asymmetric catenary function. Egg viability at different temperatures followed an inverted U-shaped curve with minimum hatch at the temperature extremes, approaching zero at the thresholds and upper developmental limits, and with maximum hatch in the medium temperature range.

Eggs of *D. cucurbitae* developed at the lowest temperatures, in the fastest time, and over the greatest range of temperatures. Eggs of *C. capitata* developed over a slightly narrower temperature range, but at slower rates. Eggs of *D. dorsalis* were affected most by low temperatures, having the highest temperature threshold, and developed at intermediate rates. Optimum development for all three species occurred between 90 and 92·5°F. The maximum and minimum temperature limits were 97·5 and 52·5°F. for *D. cucurbitae*, 96 and 53°F. for *C. capitata*, and 97·5 and 55°F. for *D. dorsalis*.

Boudreaux (H. B.). *Tetranychus tumidus* **Banks versus** *Tetranychus gloveri* **Banks (Acarina, Tetranychidae).**—*Ann. ent. Soc. Amer.* **51** no. 2 pp. 174–177, 4 figs., 9 refs. Washington, D.C., 1958.

Tetranychus tumidus Banks, which was originally described from females found on water hyacinth [*Eichhornia*] in Florida, is an important pest of cotton and other crops in the United States and elsewhere, and *T. gloveri* Banks, which was described from females taken on cotton at Baton Rouge, Louisiana, but has not since been recognised, was considered by Baker &

Pritchard [*R.A.E.*, A **43** 161] to be a synonym of it. Evidence is presented, however, from which the author concludes that it is distinct.

In July 1955, mites from water hyacinth in Louisiana were found to resemble *T. tumidus*, but the males had a small knob on the aedeagus and the eggs were a deep maroon colour. Similar males were found among mites recorded as *T. tumidus* that had been collected on cotton some 20 miles from Baton Rouge in 1953, and also on water hyacinth in Louisiana and Texas in 1955 and dahlia at Baton Rouge in 1953. The name *T. gloveri* is applied to these mites. Cultures were established on cotton, and it was found that females of *T. tumidus* that had mated laid white eggs that developed into both males and females, whereas females that had not mated laid eggs that were red on one side and gave rise to males only. Females of *T. gloveri* laid red eggs whether they had mated or not. In reciprocal crosses, only males were produced, indicating reproductive isolation [*cf.* **46** 261]. Subsequently, characters differentiating the females of the two species were found in their setal patterns; the patterns of the mites referred to *T. gloveri* were found to resemble those of type females of this species, which are shown in a table. Characters of the eggs, females and males differentiating the two species are given in another table, and it is confirmed that *T. antillarum* Banks and *T. quinquenychus* (McG.) are synonyms of *T. tumidus* [*cf.* **43** 161].

Ruckes jr. (H.). **A Synopsis of the California Deathwatch Beetles of the Genus *Ernobius* Thomson, with Descriptions of two new Species which attack Pine Cones (Coleoptera: Anobiidae).**—*Pan-Pacif. Ent.* **33** no. 4 pp. 157–161, 3 refs. San Francisco, Cal., 1957. **Observations on two Species of Pine Cone Feeding Deathwatch Beetles in California (Coleoptera: Anobiidae).**—*Ann. ent. Soc. Amer.* **51** no. 2 pp. 186–188, 4 refs. Washington, D.C., 1958.

In the first of these papers, the author gives a key to the Californian species of *Ernobius* and descriptions of the adults of both sexes of *E. melanoventris* and *E. pinicola*, spp.n. The two new species were reared from the cones of Jeffrey pine (*Pinus jeffreyi*), and the first of them also from those of ponderosa pine (*P. ponderosa*), in California in 1956.

Observations on the bionomics of *E. melanoventris* are recorded in the second paper, and those of *E. pinicola* are stated to be probably similar. The following is based on the author's summary. The larvae of *E. melanoventris* enter cones of *P. jeffreyi* that have reached their second year of development, and infestation causes destruction of the cones and a reduction in the seed crop. The life-cycle is completed in less than a year in southern California, where both adults of the first generation and larvae of a second were found in the cones in winter. There is only one generation a year in northern California, the pupae overwintering. Extensive sampling showed that up to 17 per cent. of the cone crop was infested in 1956. The larvae were parasitised by *Eubadizon ernobii* Mues., *Cephalonomia utahensis* Brues and an unidentified Ichneumonid and also attacked by predators, but little control was afforded. All stages of *Ernobius melanoventris* are briefly described.

Ruckes jr. (H.). **Some Observations on the Monterey Pine Cone Beetle, *Conophthorus radiatae* Hopkins (Coleoptera: Scolytidae).**—*Ann. ent. Soc. Amer.* **51** no. 2 pp. 214–215, 4 refs. Washington, D.C., 1958.

Observations were made during two years in the field and in 1957 in the laboratory in California on the bionomics of *Conophthorus radiatae* Hopk., a specific pest of the cones of Monterey pine (*Pinus radiata*), and the following is based on the author's summary of the results. Adults of the Scolytid attack the green, developing, second-year cones in spring and lay eggs in them. The larvae feed and pupate in the cones, destroying the seeds, and the adults, which emerge in autumn, either remain in the cones until the following spring or fly to first-year cones and overwinter in these. A generation was completed in 44 days in the laboratory. All stages of *C. radiatae* are briefly described.

Guyer (G. E.), Brown (H. M.) & Wells (A.). **An Evaluation of systemic Insecticides for Control of Hessian Fly in Michigan.**—*Quart. Bull. Mich. agric. Exp. Sta.* **40** no. 3 pp. 595–602, 1 graph, 6 refs. East Lansing, Mich., 1958.

Damage by *Mayetiola* (*Phytophaga*) *destructor* (Say) to autumn-sown wheat in Michigan is minimised by delaying sowing until oviposition declines in September. Earlier sowing is desirable, however, and the value of systemic insecticides in protecting the crop [*cf. R.A.E.*, A **45** 443] was investigated. In a preliminary test in September 1956, a seed dressing of 44 per cent. Thimet [O,O-diethyl S-ethylthiomethyl phosphorodithioate] on carbon applied to two susceptible varieties at rates equivalent to 0·5–2 lb. toxicant per acre appeared to be successful, though the seed was sown only five days before the safe date, and further tests were made in April 1957 in which this material and 50 per cent. Bayer 19639 [O,O-diethyl S-2-(ethylthio)ethyl phosphorodithioate] on carbon were applied as seed dressings at 0·5 and 1 lb. toxicant per acre and granular formulations of 2 per cent. Thimet and 2·5 per cent. Bayer 19639 were applied to the seed rows. The percentage of infested plants and numbers of larvae and pupae per 100 plants both appeared to be reduced by Thimet seed dressings, but the latter delayed germination, caused stunting and reduced the stand to an extent that was significant at the higher concentration. The other treatments were ineffective, and the poor results are attributed to the delay of five weeks that elapsed between sowing and the beginning of larval activity. In the autumn of 1957, the same treatments with the addition of two in which a fungicide was applied to the seed before treatment with Thimet or Bayer 19639 at 1 lb. toxicant per acre were tested at three places on a susceptible variety, which was sown on 27th–28th August. All treatments significantly reduced numbers of infested plants and insects, and Thimet was superior to Bayer 19639, though not significantly so. Thimet without the fungicide caused a significant reduction in stand, and both seed dressings at the higher rate temporarily retarded growth, which, however, later became significantly more vigorous than that of the control plants. In an experiment on a larger scale in another district, Thimet applied as a seed dressing at 0·75 lb. per acre gave excellent control on sowings made on 21st August and 3rd September; no infestation developed on a third sowing made on 17th September, two days after the safe date. Plants from treated seed sown on 21st August were consistently heavier than the controls and the stand was lighter, but neither difference was significant. Residues of Thimet in the plants decreased from 4·9 parts per million 13 days after sowing to an undetectable amount 44 days later.

Haines (R. G.). **Results of Field Experiments with new Insecticides and Acaricides on Michigan Fruit.**—*Quart. Bull. Mich. agric. Exp. Sta.* **40** no. 3 pp. 628–636. East Lansing, Mich., 1958.

The codling moth [*Cydia pomonella* (L.)], *Eulia velutinana* (Wlk.) and the European red mite [*Panonychus ulmi* (Koch)] have developed partial resistance to DDT, DDD and parathion, respectively, in orchards in

Michigan, and the value of alternative spray materials was tested in 1956–57. In experiments against Tetranychid mites, Genite (2,4-dichlorophenyl benzenesulphonate), Mitox (p-chlorobenzyl p-chlorophenyl sulphide), Tedion (2,4,5,4′-tetrachlorodiphenyl sulphone), Kelthane (1,1-bis(p-chlorophenyl)-2,2,2-trichloroethanol) and chlorobenzilate (ethyl 4, 4′-dichlorobenzilate) were all promising, and Genite and Mitox were especially effective against *P. ulmi* on apple when applied at the pre-bloom stage; all except Genite can be applied after flowering. Delnav (2,3-p-dioxane S,S-bis(O,O-diethyl) phosphorodithioate), Tetram 75 (hydrogen-oxalate salt of O,O-diethyl S-2-(diethylamino) ethyl phosphorothioate), Trithion (O,O-diethyl S-p-chlorophenylthiomethyl phosphorodithioate) and Thimet (O,O-diethyl S-ethylthiomethyl phosphorodithioate) were effective when used alternately with non-phosphatic compounds and also controlled aphids. The two-spotted mite [*Tetranychus telarius* (L.)] is injurious to apple, strawberry, blackberry and currant and was best controlled on the last by non-phosphatic materials; of the three tested, Kelthane applied twice in an emulsion spray at 4·6 oz. per 100 U.S. gal. was significantly superior to wettable Aramite [2-chloroethyl 2-(p-tert.-butylphenoxy)-1-methylethyl sulphite] or ovex [p-chlorophenyl p-chlorobenzenesulphate] applied three times at 3·6 and 4 oz. per 100 U.S. gal., respectively. The heaviest outbreak of *C. pomonella* that has occurred since the introduction of DDT developed on apple in south-western Michigan in 1957 and caused losses despite the use of standard spray schedules. In tests, fortnightly applications of Guthion (O,O-dimethyl S-(4-oxo-benzotriazino-3-methyl) phosphorodithioate), Sevin (1-naphthyl N-methylcarbamate) and, to a less extent, diazinon (O,O-diethyl O-2-isopropyl-4-methyl-6-pyrimidinyl phosphorothioate), all at 8 oz. toxicant per 100 U.S. gal., gave better control than the standard schedule of DDT with parathion applied at ten-day intervals, and Guthion appeared to be effective against both larvae and adults; Sevin was not toxic to mites. *E. velutinana* caused considerable damage in parts of the State in 1957. Guthion and Phosdrin (dimethyl 2-methoxycarbonyl-1-methylvinyl phosphate), both at 8 oz. per 100 U.S. gal., and Sevin at 1 lb. gave excellent control when applied to apple at 14-day intervals throughout the season, beginning at petal-fall. Of the other materials tested, Thimet and 12008 (O,O-diethyl S-isopropylthiomethyl phosphorodithioate) at 1 lb. were not significantly superior to the standard DDD sprays and showed undesirable physical properties, and repeated applications of Trithion damaged the trees.

Weekly applications of DDT with parathion throughout the season have given satisfactory control of the oriental fruit moth [*Cydia molesta* (Busck)] on peach. In a test in 1957, Guthion at 8 oz. per 100 U.S. gal. applied fortnightly was outstanding and significantly superior to DDT at 8 oz. or 1 lb. and parathion at 3·6 oz. in similar schedules; Thimet at 1 lb. gave about the same control as DDT and parathion, and Trithion, Sevin and 12008 were relatively ineffective. Phosphatic compounds appeared most effective against the eggs and newly hatched larvae.

During work on the control of strawberry pests in 1956–57, four Tortricids were collected, of which *Ancylis comptana* (Froel.) and *Tortrix* (*Archips*) *rosaceana* (Harris) were the commonest and *T.* (*A.*) *obsoletana* (Wlk.) and *E. velutinana* were of minor importance. The Cercopid, *Philaenus leucophthalmus* (L.), caused marked reductions in yield and hampered harvesting when numerous. Dieldrin at 4 and 8 oz. and BHC at 4 oz. γ isomer per 100 U.S. gal. gave complete control of *P. leucophthalmus*. A single application of Guthion, Nialate (O,O,O′,O′-tetraethyl S,S′-methylene bisphosphorodithioate [ethion]) or 1189 (2,3,3a,4,5,6,7,7a,8,8-decachloro-3a,4,7,7a-tetrahydro-4,7-methanoindene-1-one) at 8 oz. controlled both *P. leucophthalmus* and the Tortricids, and Trithion and Sevin at 8 oz. and Thimet at 1 lb. all gave good control, especially of the Cercopid. DDD at 1 lb. per 100 U.S. gal. was very effective against the Tortricids, and a pre-bloom spray of dieldrin with DDD is suggested as a means of preventing an increase of the Tortricids or the Cercopid.

SCHUDER (D. L.). **A specific Virus Disease for Control of the European Pine Sawfly,** *Neodiprion sertifer* **(Geoff.).**—*Proc. Ind. Acad. Sci.* **66** pp. 101–102, 6 refs. Indianapolis, Ind., 1957.

Neodiprion sertifer (Geoffr.) is possibly the most injurious of the insects that infest pine in Indiana. It appeared there about 1950 in its spread westward from New Jersey, and now occurs in the northern half of the State. In 1953, the polyhedral virus used against it in Canada [*cf. R.A.E.*, A **43** 263] was introduced, and tests in which it was distributed in sprays over 600 acres of infested plantations showed that it was very effective, causing nearly 90 per cent. mortality of larvae [*cf.* also **42** 24] and being transmitted to the next generation by the survivors. The best time for application is in the first half of May, while the larvae are still small and defoliation has not yet become severe.

DODGE (H. R.), TERRELL (T. T.) & JOHNSON (P. C.). **Report of the Entomological Phases of the 1955 Montana Spruce Budworm Control Project.** —*Misc. Publ. Intermount. For. Range Exp. Sta.* no. 9, [1+] ii + 12 [+7] pp., 2 maps, 1 ref. Ogden, Utah, 1956.

FURNISS (M. M.). **Entomological Aspects of the 1955 Spruce Budworm Control Project in southern Idaho.**—*Op. cit.* no. 10, [1+] 22 [+13] pp., 5 figs., 3 refs. 1957.

It is stated in the first of these reports [*cf.* also *R.A.E.*, A **46** 488] that 372,652 acres of forest consisting of Douglas fir (*Pseudotsuga menziesii*) and true fir (*Abies*) in northern Idaho and western Montana were sprayed by aircraft for the control of *Choristoneura fumiferana* (Clem.) in 1955. The spray used contained 1 lb. technical DDT, 1·25 U.S. quarts auxiliary hydrocarbon solvent and sufficient fuel oil to make 1 U.S. gal., and it was applied at 1 U.S. gal. per acre. The mass median diameter of the droplets averaged 150 μ. Details of the several operations are given. They were begun when 50 per cent. of the larvae were in the fifth and sixth instars, and the control obtained averaged over 90 per cent.

Similar large-scale operations in the same year in southern Idaho are described in the other report. They were the first to be carried out in that area, and 893,212 acres of forest were sprayed. The mortality obtained averaged 95 per cent.

GUAGLIUMI (P.). **Segundo suplemento a la lista de los insectos de la caña de azúcar en Venezuela. 1956–58.** [Second Supplement to the List of Sugar-cane Insects in Venezuela. 1956–58.]—*Agron. trop.* **7** no. 4 pp. 217–221, 3 refs. Maracay, 1958.

This paper, which is supplementary to previous ones [*R.A.E.*, A **44** 221; **46** 452], contains records of ten species of insects, none of them very injurious, found feeding on sugar-cane in Venezuela, mostly in Lara and Yaracuy, for the first time in 1956–58, and a list of 28 parasites and predators not previously recorded from insects associated with sugar-cane there.

Guagliumi (R.). **A new Locust Invasion in Venezuela.**—*FAO Plant Prot. Bull.* **7** no. 2 pp. 17–18. Rome, 1958.

Grasshoppers are seldom of more than local importance in Venezuela, but a severe invasion of the grasslands north of the Capanaparo River, in the State of Apure, was reported in April 1958, the grasshoppers having advanced slowly northwards, crossing canyons and rivers, during the previous three years. Investigations later in the month showed the presence of large swarms of adults that moved slowly but did not fly, and grass destruction was severe. The species was identified as *Rhammatocerus viatorius* (Sauss.), an Acridid that had not previously been recorded as migratory or injurious. Smaller infestations also occurred elsewhere. Loss of grazing was not the only result, since the cattle ate large numbers of hoppers and adults in August–September, when they were most numerous, which affected the quality of the meat and milk. The outbreak is regarded as of importance, since it may constitute a threat to a new irrigation scheme less than 100 miles away.

Vega (J.). **Grape *Phylloxera* Infestation in the Region of Cuyo, Argentina.** —*FAO Plant Prot. Bull.* **7** no. 3 pp. 39–42, 1 map, 1 ref. Rome, 1958.

The following is virtually the author's summary. Although *Phylloxera* [*vitifoliae* (Fitch)] has been known for about 40 years to occur on vines in the Cuyo area (San Luis, Mendoza and San Juan) [*cf. R.A.E.*, A **34** 299], heavy outbreaks with economic consequences have not been experienced up to the present. The reasons for this delay are unknown, for the factors involved are complex. It might be that the insect is still in a state of dispersion, or that the ecological conditions required for vine-growing in the Cuyo area, in addition to irrigation and to fertilisation of the soil by the substances carried with irrigation water, are so favourable, that the damage caused is not noticeable. This should not lead to an exaggerated optimism. All depends on time, and Argentina will probably not escape the consequences of *Phylloxera*, which have been disastrous in other countries.

Ibarra Grasso (A.). **Sobre dos ácaros de interés agrícola nuevos para la Argentina.** *Penthaleus major* (**Dugès**) **y** *Petrobia latens* (**Müller**). [On two Mites of agricultural Interest new for Argentina, *Penthaleus major* and *Petrobia latens.*]—*An. Soc. cient. argent.* **166** pt. 1–2 pp. 41–44, 1 fig., 3 refs. Buenos Aires, 1958.

Penthaleus major (Dugès) caused severe damage to young wheat and oats in the south of the Province of Buenos Aires and the south-west of La Pampa at the end of the winter of 1957, and *Petrobia latens* (Müller) was observed on young wheat in the north of San Luis at the end of the winter of 1953. The first had already been noted in 1950, but the second is recorded in Argentina for the first time. A dust of 20 per cent. BHC at about 10 lb. per acre gave rapid and almost complete control of *Penthaleus*, but a 10 per cent. dust failed against *Petrobia*. The morphology and world distribution of the two mites are reviewed.

Millán (E.) & De Santis (L.). **Himenópteros parásitos de** *Evetria buoliana* **en las Repúblicas del Plata.** [Hymenopterous Parasites of *Rhyacionia buoliana* in the Plata Republics.]—*Rev. Invest. agric.* **12** no. 1 pp. 105–110, 1 fig. Buenos Aires, 1958. (With a Summary in English.)

Rhyacionia (*Evetria*) *buoliana* (Schiff.) is spreading and causing damage of economic importance to pine in Argentina and Uruguay. Parasites have been reared from it in both countries, and a list of these is given, with notes on distribution, and sometimes morphology, and locality records. Those recorded from *R. buoliana* in Argentina comprise *Brachymeria pseudovata* Blanch., *Perisierola* sp., *Bracon* sp., *Pygostolus sticticus* (F.), *Pimpla* (*Coccygomimus*) *zenobia* Schrottky, *Itoplectis* (*P.*) *behrensiella* (Blanch.), *Nemeritis* (*Idechthis*) *pastranai* (Blanch.), and *Hemiteles pastranai*, sp. n., which is described from adults of both sexes. Those recorded from *R. buoliana* in Uruguay are *Ephialtes* (*Calliephialtes*) *minutus* Brullé and *Itoplectis* (*P.*) *oeceticola* (Brèthes).

Calcagnolo (G.) & Leiderman (L.). **As pulverizações concentradas no combate ao "bicho-mineiro" do cafeeiro.** [Concentrated Sprays in the Control of *Leucoptera coffeella*.]—*Biológico* **23** no. 11 pp. 203–219, 13 refs. São Paulo, 1957.

Low-volume sprays containing BHC, dieldrin, parathion and toxaphene at 0·25, 0·4, 0·125 and 2 per cent., respectively, from emulsion concentrates and at 0·1, 0·16, 0·05 and 0·8 per cent. from wettable powders were tested against *Leucoptera* (*Perileucoptera*) *coffeella* (Guér.) on coffee in São Paulo in 1955. Treatment was begun on 13th May and repeated at intervals of three weeks in one series and five in another until 4th October, when rain terminated the attack. Counts of mined leaves were made at intervals, and the results showed that the wettable-powder sprays were in general inferior to the emulsions and that there was little advantage in spraying at three-weekly rather than at five-weekly intervals. Dieldrin, toxaphene and BHC were all effective, but parathion gave poor results.

de Souza jr. (M. F.), Giannotti (O.) & Almeida (P. R.). **O contrôle de algumas pragas iniciais do algodoeiro por meio do tratamento das sementes com novos tipos de inseticidas sistêmicos.** [The Control of early Pests of Cotton by Means of Seed Treatment with new Kinds of Systemic Insecticides.]—*Biológico* **23** no. 12 pp. 227–236, 2 refs. São Paulo, 1957.

Further experiments were carried out in São Paulo in 1956–57 on the value of seed treatments in protecting cotton from attack by insects and mites [*cf. R.A.E.*, A **46** 499]. The materials tested were 50 per cent. Disyston (O,O-diethyl S-2-(ethylthio)ethyl phosphorodithioate), 44·7 per cent. Thimet (O,O-diethyl S-ethylthiomethyl phosphorodithioate), 50 per cent. Thiometon (O,O-dimethyl S-2-(ethylthio)ethyl phosphorodithioate), 50 per cent. endothion (2-(O,O-dimethyl phosphorothiolomethyl)-5-methoxy-4-pyrone), 25 per cent. schradan, and 8 per cent. of a concentrated extract of the wood of *Picrasma* sp., all on activated carbon, the dusts being mixed with the seeds at 4 per cent. for the first four, 8 per cent. for schradan and 6 per cent. for the *Picrasma* extract, and 2·5 per cent. aldrin, which was applied in the rows at about 1 oz. per 10 yd. The seed was sown on 10th December, and observations on 26th December showed that germination was normal except for the Thimet treatment, which reduced it by about 20 per cent. Counts of *Aphis gossypii* Glov. were made five times between 7th January and 11th March, and they showed that all treatments but the last gave good immediate control, that Disyston, schradan, Thimet and Thiometon maintained it for 60 days after sowing, but that only Disyston was still highly effective after 70 days. This material was still of value after 100 days, and it also gave outstanding results against *Tetranychus telarius* (L.), which was fairly well controlled by schradan and Thiometon but not by other treatments, aldrin and *Picrasma* extract even appearing to favour it. Disyston and schradan were fairly effective against *Hemitarsonemus latus* (Banks), infestation by which was irregular. The height of the plants 115 days after sowing was increased by 70 per cent. by Disyston and by 50, 51·4 and 41·4 per cent. by Thimet, schradan and Thiometon, respectively, and fruiting was increased proportionally, being nearly trebled by Disyston.

FRAWLEY (J. P.), COOK (J. W.), BLAKE (J. R.) & FITZHUGH (O. G.). **Effect of Light on chemical and biological Properties of Parathion.**—*J. agric. Fd Chem.* **6** no. 1 pp. 28–30, 3 graphs, 12 refs. Easton, Pa., 1958.

The following is based on the authors' summary. Exposure of parathion to ultraviolet light gives rise to a mixture of compounds, notably paraoxon, that possess greater *in vitro* anticholinesterase activity than does parathion but react less to the chemical method of determination of Averell & Norris and have reduced toxicity to flies [*Musca domestica* L.]. As similar conversion might occur on sprayed crops, the ability of the method to detect all toxic residues was in question. Samples of parathion, one of which had been exposed to ultraviolet light, were therefore fed at sub-acute rates to rats and their anticholinesterase activity determined. There was a loss in activity resulting from exposure to ultraviolet light, and it proved to be close to the loss in response to the chemical method of determination.

HORNSTEIN (I.). **Spectrophotofluorometry for Pesticide Determinations.**—*J. agric. Fd Chem.* **6** no. 1 pp. 32–34, 7 refs. Easton, Pa., 1958.

The determination of concentrations of less than 0·1 part per million of residues of chemicals used in plant protection presents difficulties by conventional procedures, but fluorometric methods can often be used to determine as little as 0·01 μg. per ml. solution. In the investigations described, spectrofluorometry was found suitable for the determination of traces of several of the chemicals tested, including Guthion [O,O-dimethyl S-(4-oxobenzotriazino-3-methyl) phosphorodithioate], which hydrolyses to form a fluorescent compound, Potasan [O,O-diethyl O-4-methyl-7-coumarinyl phosphorothioate] and piperonyl butoxide, but not DDT, diazinon [O,O-diethyl O-2-isopropyl-4-methyl-6-pyrimidinyl phosphorothioate] or various other insecticides. The technique is described, and it is stated that fluorescence may be expected of compounds having conjugated double bonds in their molecular structure.

GUNTHER (F. A.) & others. **Persistence of Residues of 2,3-p-Dioxane-dithiol S,S-bis(O,O-Diethyl Phosphorodithioate) as an Acaricide on and in mature Lemons and Oranges.**—*J. agric. Fd Chem.* **6** no. 3 pp. 210–211, 3 graphs, 4 refs. Easton, Pa., 1958.

In view of the effectiveness of Hercules AC-528 (2,3-p-dioxane S,S-bis(O,O-diethyl phosphorodithioate) against *Panonychus* (*Metatetranychus*) *citri* (McG.) and other Tetranychid mites on *Citrus* in California [*cf. R.A.E.*, A **46** 224], a study was made of the persistence of the residues on the ripe fruits. Navel orange and lemon trees were sprayed in February–March 1956 with 6–24 and 12–48 oz. 25 per cent. emulsion concentrate, respectively, per 100 U.S. gal. or 24 oz. 25 per cent. wettable powder per 100 U.S. gal., and residues were sampled over periods of up to 86 days on oranges and 98 days on lemons. Less than 0·03 part per million was found at any time in the pulp. Residues on and in the peel were variable. They increased in general with spray concentration, reaching 9·7 p.p.m. for the strongest emulsion spray and 3·6 p.p.m. for the wettable powder after two days on orange and 24·8 p.p.m. after two days and 10 p.p.m. after three days, respectively, on lemon, but declined progressively to 5 and 1 p.p.m. on orange and 9·5 and 1·6 p.p.m. on lemon. They were very much lower for the weaker emulsion sprays. The half-life values were determined as about 95 days on oranges and 85 on lemons. Processing of fresh peel into cattle feed resulted in 40 per cent. reduction in residues.

ARTHUR (B. W.) & CASIDA (J. E.). **Biological Activity of several O,O-Dialkyl Alpha-Acyloxyethyl Phosphonates.**—*J. agric. Fd Chem.* **6** no. 5 pp. 360–365, 1 graph, 23 refs. Easton, Pa., 1958.

The following is based mainly on the authors' summary. In view of the low mammalian toxicity of Dipterex (O,O-dimethyl 2,2,2-trichloro-1-hydroxyethylphosphonate), several O,O-dialkyl 2,2,2-trichloro-1-acyloxyethylphosphonates and related derivatives were compared for toxicity to *Musca domestica* L. and rats and for anticholinesterase activity. The most selectively toxic was O,O-dimethyl 2,2,2-trichloro-1-n-butyryloxyethylphosphonate, termed butonate, which was as effective as Dipterex against the fly but much less toxic than Dipterex to rats. Studies of metabolism in various insects and rats and also *in vitro* with mammalian tissue showed that it was hydrolysed at the acyl group, the phosphorus-carbon bond, and possibly the phosphorus-oxygen-methyl bond. The initial site of *in vivo* hydrolysis appeared to be a major factor in its selective toxicity.

STEINHAUS (E. A.) & SMITH (R. F.). Ed. **Annual Review of Entomology. Volume 4.**—9 × 6 in., vii + 467 pp., illus., many refs. Palo Alto. Cal., Annual Reviews, Inc., 1959.

The reviews in this fourth volume of a series [*cf. R.A.E.*, A **45** 70; **46** 255, etc.] comprise: **Insect Blood Cells,** by V. B. WIGGLESWORTH (pp. 1–16, 87 refs.); **Culture of Insect Tissues,** by M. F. DAY & T. D. C. GRACE (pp. 17–38, 123 refs.); **Pheromones (Ectohormones) in Insects,** by P. KARLSON & A. BUTENANDT (pp. 39–58, 120 refs.), in which pheromones are defined as substances that are secreted by an animal to the outside and cause a specific reaction in a receiving animal of the same species, and examples of them in insects are discussed, including the sex attractants produced by the females or by both sexes of certain species; **Insect Pigments,** by R. I. T. CROMARTIE (pp. 59–76, 104 refs.); **Taxonomic Problems with closely related Species,** by W. J. BROWN (pp. 77–98, 87 refs.); **Ecology of Cerambycidae,** by E. G. LINSLEY (pp. 99–138, 4 figs., 325 refs.), in which information is brought together on the environmental relations of Longicorns, including features that have influenced evolution and survival; **Biology of Aphids,** by J. S. KENNEDY & H. L. G. STROYAN (pp. 139–160, 107 refs.); **The Biology of Parasitic Hymenoptera,** by R. L. DOUTT (pp. 161–182, 86 refs.); **Bioclimatic Studies with Insects,** by P. S. MESSENGER (pp. 183–206, 198 refs.); **Ethological Studies of Insect Behavior,** by G. P. BAERENDS (pp. 207–234, 196 refs.); **Experimental Host-Parasite Populations,** by T. BURNETT (pp. 235–250, 79 refs.); **Biological Control of Weeds with Insects,** by C. B. HUFFAKER (pp. 251–276, 117 refs.); **Microbial Control of Insect Pests,** by Y. TANADA (pp. 277–302, 225 refs.), in which most of the pathogens considered are viruses, bacteria, fungi or protozoa; **On the Mode of Action of Insecticides,** by F. P. W. WINTERINGHAM & S. E. LEWIS (pp. 303–318, 110 refs.), in which the insecticides dealt with are principally DDT and structurally related compounds, γ BHC and the aldrin group, and the organophosphorus compounds; **Biological Assay of Insecticide Residues,** by S. Nagasawa (pp. 319–342, 135 refs.), in which methods of bioassay using insects or other organisms are reviewed; **Deciduous Fruit Insects and their Control,** by M. M. Barnes (pp. 343–362, 186 refs.), in which the pests concerned include orchard mites as well as insects; **Seed Treatment as a Method of Insect Control,** by W. H. Lange jr. (pp. 363–388, 6 figs., 189 refs.); **Fleas and Disease,** by W. L. Jellison (pp. 389–414, 132 refs.); and **Insects and the Epidemiology of Malaria,** by P. F. Russell (pp. 415–434, 135 refs.).

Martin (Hubert). **The Scientific Principles of Crop Protection.**—4th edn., 9¼ × 6 in., viii + 359 pp., many refs. London, E. Arnold Ltd., 1959. Price £3 5*s*.

This fourth edition of the author's handbook on the protection of crops from insects, fungi and weeds follows the plan of the third [*R.A.E.*, A **28** 433] but has been brought up to date to include information on subsequent developments. The chief of these is the discovery and use of a wide range of synthetic organic insecticides, and a special chapter on them is included in which emphasis is laid on their biochemistry and toxicology.

Liu (Yu-ch'iao) & Shih (Chen-hua). **Preliminary Study on the Life History of the Larch Caterpillar** *Dendrolimus sibiricus* **Tschetw. (Lepidoptera, Lasiocampidae).** [*In Chinese.*]—*Acta ent. sin.* **7** no. 3 pp. 251–260, 1 graph, 3 refs. [Peking] 1957. (With a Summary in English.)

Dendrolimus superans (Btlr.) (*sibiricus* Chtv.) occurs in Inner Mongolia and adjacent Chinese provinces to the east and attacks many species of pines but prefers *Larix olgensis*, which is sometimes severely injured. A generation is completed in one or in two years, the larvae passing through seven and up to nine instars, respectively. The partly grown larvae leave the trees and hibernate under débris on the ground, and in the spring, when the average temperature rises above 10°C. [50°F.], they crawl up the trunks. Most cocoons are formed on the trees, though a few occur on shrubs. The adults emerge in July or August, and the females oviposit over 1–10, generally seven, days when they have mated and for up to 13 days when they have not. Fertilised females lay about 300 eggs each, mostly in the first night after pairing. The main parasites of the eggs are *Telenomus dendrolimusi* Chu and a species of *Ooencyrtus*; the larvae are parasitised by *Apanteles eucosmae* Wlkn., *A. ordinarius* (Ratz.), *Campoplegidia* (*Campoplex*) *proxima* (Först.) and *Rogas spectabilis* (Mats.), and the pupae by unidentified Diptera.

Lung (Cheng-te) & others. **A preliminary biological Study of two Egg-parasites of the Pine Caterpillar.** [*In Chinese.*]—*Acta ent. sin.* **7** no. 3 pp. 261–284, 2 figs., 8 refs. [Peking] 1957. (With a Summary in English.)

During 1954 and 1955, the bionomics of *Telenomus dendrolimusi* Chu, which is a well-known parasite of the eggs of *Dendrolimus punctatus* (Wlk.) in China, and *Telenomus* sp., which is here reported for the first time as parasitising them, were investigated in the field at three localities in south-eastern China; in one of these, Nanking, *Telenomus* sp. was four times as numerous as *T. dendrolimusi*. The larvae of *Telenomus* sp. overwinter in the eggs of *Lymantria* sp., winter mortality is low, and the adults emerge from the time the first *Dendrolimus* eggs are laid in spring. The species is superior to *T. dendrolimusi* for biological control. In Nanking it has 8–9 generations a year, as compared with 10–12 for *T. dendrolimusi*, and females are four times as numerous as males. They lay an average of 30 eggs each, twice as many as *T. dendrolimusi*. The oviposition period is short, and the species is easy to rear on a large scale in the laboratory. When *Dendrolimus* eggs that were one day old were kept at 4°C. [39·2°F.] for a month, the embryos developed normally; mature larvae of *Telenomus* sp. withstood this temperature well, and adults that emerged from eggs so treated produced normal offspring.

CHUNG (Chi-chien) & WEI (Hung-chuen). **The Control of the White Grubs and Wireworms by Soil Treatment.** [*In Chinese.*]—*Acta ent. sin.* **7** no. 3 pp. 285–293, 32 refs. [Peking] 1957. (With a Summary in English.)

Laboratory and field tests in northern China showed that the effects of BHC in protecting cereal seedlings against attack by Lamellicorn larvae and wireworms varied with agricultural conditions and also with the time and method of application. The most effective control was obtained by applying 6 per cent. γ BHC at 6·75–20·25 lb. per acre. The insecticide was broadcast in 5–10 times its weight of dried soil or sand and ploughed or harrowed into the soil immediately to a depth of 4–8 in. The LD50 for larvae of *Lachnosterna* (*Holotrichia*) *diomphalia* Bates, the most important of the Lamellicorns, was 0·039 mg. γ BHC per g. body weight.

HSIA (Sun-yun). **Basic List of parasitic Hymenoptera (Hymenoptera, Parasitica) attacking important Pests of Rice in the Province of Hunan, China.** [*In Chinese.*]—*Acta ent. sin.* **7** no. 3 pp. 295–319, 21 figs., 10 refs. [Peking] 1957. (With a Summary in Russian.)

Descriptions are given of 33 species of Hymenoptera observed parasitising important insect pests of rice in Hunan in 1954–55. The pests concerned are *Chilo suppressalis* (Wlk.) (*simplex* (Btlr.)), *Schoenobius incertulas* (Wlk.), *Sesamia inferens* (Wlk.), *Naranga aenescens* Moore, *Cnaphalocrocis medinalis* (Gn.), *Parnara guttata* (Brem.), *Lagynotomus assimulans* (Dist.) and *Hispa armigera* Ol., and they were parasitised by 11, 6, 1, 9, 4, 12, 1 and 1 species, respectively; the species concerned, the stages attacked and their local distribution are shown in a table. Those of most practical importance were the egg-parasites, *Trichogramma japonicum* Ashm. and *Telenomus beneficiens* (Zehnt.), which parasitised *Chilo* and *Schoenobius*, *Trichogramma evanescens* Westw., which parasitised *Schoenobius*, and *Telenomus dignus* (Gah.) and *T. mitsukurii* Ashm., which parasitised *Schoenobius* and *Lagynotomus*, respectively.

ARNOL'DI (K. V.). **Attempts to determine the Characteristics of Outbreaks of *Eurygaster integriceps*.** [*In Russian.*]—*Zool. Zh.* **35** pt. 7 pp. 990–1003, 18 refs. Moscow, 1956. (With a Summary in English, suppl. pp. 5–6.)

The investigations described were carried out in the Kuban district, to the north-west of the Caucasus, during an outbreak of *Eurygaster integriceps* Put. on cereals in the Province of Krasnodar. The outbreak began about

1947 and reached a peak in 1951, after which there was a decline in the numbers of the bug, but the increase was renewed in 1952 [*cf. R.A.E.*, A **46** 8] and was still in progress in 1955. The author reviews the various ways in which outbreaks of the Pentatomid are studied in the Soviet Union [*cf.* **40** 307–311; **46** 8–10], describes its hibernation habits in the Kuban, where the population is of the migratory type [*cf.* **46** 10], and records observations on the hibernating bugs, carried out largely in 1954–55, but also in the earlier years of the outbreak. They showed that there was a correlation between the numerousness and vitality of the bugs and the height to which they migrated for hibernation, the density of the bugs at high altitudes increasing in outbreak years and decreasing in years of population depression. There was also a tendency for the ratio of females to males in the higher hibernation sites to increase during outbreak years. These trends can be used in forecasting changes in the bug population, and gave better and more rapid results in 1954 than the method of morpho-functional analysis [*cf.* **46** 8, etc.].

KALANDADZE (L. P.) & BAGDAVADZE (A. I.). **Biological Peculiarities of the Cherry Fly** (*Rhagoletis cerasi* **L.**) **in the Georgian Republic.** [*In Russian.*]—*Zool. Zh.* **35** pt. 8 pp. 1177–1185, 19 refs. Moscow, 1956. (With a Summary in English, suppl. p. 9.) **Results of a Study of the biological Peculiarities of the Cherry Fly** (*Rhagoletis cerasi* **L.**) **and of Means of controlling it in Georgia.** [*In Georgian.*]—*Trud. Inst. Zashch. Rast.* **12** pp. 49–77, 1 graph, 20 refs. Tiflis, 1957. (With a Summary in Russian.)

Work on the bionomics and control of *Rhagoletis cerasi* (L.) in the Georgian Republic was begun in 1941, and substantially similar accounts of the work are given in these two papers. The Trypetid is widely distributed in the region. It is one of the most important pests of cherries there and also infests the fruits of barberry (*Berberis vulgaris*); it was not observed on *Lonicera iberica*. Both sweet cherries and sour cherries are attacked, infestation reaching 67–92 and 40–85 per cent., respectively, according to variety. The developmental cycle was completed in a year, but many of the pupae remained in diapause for two winters. Exposure to low temperature was needed for adult emergence. Exposure for two months was sufficient, but one month was not, more than half the pupae remaining in diapause. Adult emergence began in the second or third ten days of May in eastern districts and 8–10 days earlier in western ones. The adults required to feed before becoming sexually mature and were active on warm, sunny days. The fertilised females deposited an average of 37–45 eggs each, about a fortnight after emergence, and the oviposition period lasted until the beginning of July in the east and until mid-June in the west. The eggs were laid in the ripening fruits, early varieties usually escaping infestation, and hatched in 5–8 days. The larvae fed in the fruits for 13–22 days and then entered the soil, in which they pupated after about a week. Movement to the soil began on 15th–20th June in the east and on 10th–15th June in the west.

The cultural measures of control recommended on the basis of experiments and observations comprise the planting of early varieties of cherry, the suppression of wild cherries and other host fruits near orchards, cultivation of the soil to a depth of at least 6–8 in. beneath the trees to destroy the pupae, early frequent picking, exposure of the picked fruits in a thin layer on a tarpaulin or cement floor and destruction of the larvae that leave them within two days, and the disposal of fallen fruits. In tests with insecticides, good results were given by dusting the trees twice with 5·5 per cent. DDT at the rate of 22·5–31·5 lb. toxicant per acre before the beginning of oviposition, the dates suggested being 10th May in the west and 15th May in the east for the first application and 10–14 days later for the second. BHC gave good results when applied as a dust to the soil beneath the trees at a rate of 72 lb. per acre at the time of the migration of the larvae to the soil.

DOLIDZE (G. V.). **The Study of Problems of the Ecology of the Cabbage Moth** (*Barathra brassicac* **L.) in Georgia.** [*In Georgian.*]—*Trud. Inst. Zashch. Rast.* **12** pp. 79–100, 22 refs. Tiflis, 1957. (With a Summary in Russian.)

Laboratory experiments were carried out in the Georgian Republic on the effects of temperature and other factors on *Mamestra* (*Barathra*) *brassicae* (L.). The adults were normally active at temperatures of 16–32°C. [60·8–89·6°F.], but became torpid at lower temperatures and died in 27 days at 9°C. [48·2°F.]. Males died in 12–24 and females in 6–24 hours at 33°C. [91·4°F.]. Optimum temperatures for oviposition were 21·8–25·2°C. [71·24–77·36°F.], the number of eggs laid decreasing sharply at lower temperatures and gradually at higher ones. The optimum for egg development was 23·5–26·5°C. [74·3–79·7°F.], at which the larvae hatched in 4–5 days. The upper and lower limits were 30 and 11·5°C. [86 and 52·7°F.]. Optimum conditions for the larvae, at which all developed and pupated in 26–30 days, were 20–24·5°C. [68–76·1°F.]. The upper and lower limits were 30·6 and 16°C. [87·08 and 60·8°F.]. Exposure to −10°C. [14°F.] caused complete mortality in 48 hours. The optimum temperature for the pupae was 20–24°C. [68–75·2°F.], and the upper and lower limits 31 and 14·8°C. [87·8 and 58·64°F.]. At −15°C. [5°F.], all the pupae died in 72 hours. Observations on the effect of solar radiation on the eggs and pupae showed that freshly laid eggs all died in an hour with exposure to 70·26 calories, and eggs 3–4 days old in 30–40 minutes. All the pupae were killed by exposure to 60·41–68·22 calories for 70 minutes. Observations on the depth of pupation in various soils are recorded. It was greatest in sandy soil, but also varied with the moisture content. If the soil was very wet, the larvae were unable to enter it and died on the surface. In a field test, the proportion of adults to emerge to the surface decreased with increasing depth of pupation, falling from 90 per cent. at 2 in. to 0 at 12 in., although development to the adult stage was not affected.

OTKHMEZURI (L. T.). **The Results of a Study of chemical Means of controlling the Vine Mealybug** (*Pseudococcus citri* **Risso).** [*In Georgian.*]—*Trud. Inst. Zashch. Rast.* **12** pp. 101–123, 6 figs., 30 refs. Tiflis, 1957. (With a Summary in Russian.)

Experiments in the Georgian Republic on the control of *Planococcus* (*Pseudococcus*) *citri* (Risso) showed that spraying or brushing infested vines with 4–8 per cent. mineral oil emulsion in winter was of no use, even when DDT was added. In summer sprays, 0·5 per cent. anabasine sulphate gave up to 85, 83, 31 and 18 per cent. kill of first-, second- and third-instar nymphs and adults, respectively, and a 1·25 per cent. spray killed up to 42 per cent. of the adults; nicotine sulphate acted similarly. An emulsion of 4 per cent. sunflower-seed oil gave complete mortality of first-instar nymphs and up to 30 per cent. kill of adults, but a spray of 3 per cent. mineral oil, though very toxic to the mealybug, caused severe plant injury. A DDT emulsion spray was effective alone or with bordeaux mixture, killing up to 100 per cent. of first- and second-instar nymphs, 91 per cent. of third-instar nymphs and 59 per cent. of the adults, but required up to a week to become effective, and 0·25 per cent. parathion gave very good kill of all stages except the eggs.

The mealybug is difficult to control because it is highly polyphagous, has four generations a year, reproduces at a high rate and is protected by its waxy covering and by its habit of developing beneath the bark and on the lower surfaces of the leaves.

KHARAZISHVILI (K. V.). **On the Study of the Oak Shoot Moth** (*Stenolechia gemmella* **L.) in Georgia.** [*In Russian.*]—*Trud. Inst. Zashch. Rast.* **12** pp. 177–180, 2 figs., 6 refs. Tiflis, 1957.

Stenolechia gemmella (L.), all stages of which are briefly described and which infests oak in Europe, including European Russia [*cf. R.A.E.*, A **25** 403], was found on this tree in the Georgian Republic for the first time in 1953 and subsequently in the following year. The adults of the two generations emerged in May–June and August–September, respectively. The site of oviposition is not known, but the eggs are probably laid at the base of the shoots close to the points at which the larvae enter the latter. The larvae bore in the shoots for distances of up to 18 in. and kill them if the mines reach 4 in. or more. Pupation occurs in the shoots or sometimes in cracks in the bark on the trunks, beneath moss or lichens, and winter is passed in the pupal stage. No method of control is known.

SUZDAL'SKAYA (M. V.). **The Relation of the Larvae of a Chrysopid** (*Chrysopa ventralis* **Curt., ssp.** *prasina* **Burm.) to the White Muscardine Fungus.** [*In Russian.*]—*Zool. Zh.* **35** pt. 10 pp. 1585–1586, 1 ref. Moscow, 1956. (With a Summary in English, suppl. pp. 13–14.)

During investigations on the hibernation of *Eurygaster integriceps* Put. in the forests of the Krasnodar region of the Soviet Union, larvae of *Chrysopa ventralis* subsp. *prasina* Burm. were observed covered with a layer of mycelium and spores of a fungus that proved to be *Beauveria bassiana*. They were moving about normally in the litter, and portions of the fungus remained on their cocoons when they pupated. The fungus was cultured and found to be highly virulent for *E. integriceps*, *Galleria mellonella* (L.) and *Cydia pomonella* (L.), but harmless to the Chrysopid larvae. The relation of the fungus to the latter appeared to be of a symbiotic nature, and they were observed in the forest litter to transfer it from dead examples of *E. integriceps* and other insects to their own backs. The finding is of interest in view of the possible importance of the Chrysopid in the natural dissemination of a beneficial fungus.

SEMENOV (A. E.) & KUZNETSOV (V. I.). **The Siberian Onion Moth**—*Acrolepia alliella*, **sp.n. as a new Pest of Onion in the Far North.** [*In Russian.*]—*Zool. Zh.* **35** pt. 11 pp. 1676–1680, 3 figs., 5 refs. Moscow, 1956.

Onions and other species of *Allium* are being extensively grown in the Far North of the Russian Union as an article of diet. They were observed in the Krasnoyarsk region in 1954 to be infested by a species of *Acrolepia* here described from the adults of both sexes and the larvae as *A. alliella*, sp.n., by Kuznetsov, who also gives characters distinguishing them from *A. assectella* (Zell.), the common onion moth. Onions, spring onions, garlic and wild chives were all attacked. Eggs were laid on the leaves in the first ten days of July, and the larvae fed internally in the leaves, particularly in the upper parts. Damage became apparent about 8th–10th July and was severe during the second half of the month. Pupation began on 18th July, reaching its peak on 23rd, and the adults emerged in cages between 1st and 10th August. A few examples of *A. assectella* were observed among them. The collection and destruction of all yellowing leaves and dusting with DDT are recommended for control. *A. alliella* is further recorded from the Ussuri region.

KOVALEVA (M. F.). **The Effectiveness of *Trichogramma* in the Control of the Codling Moth.** [*In Russian.*]—*Zool. Zh.* **36** pt. 2 pp. 225–229. Moscow, 1957. (With a Summary in English.)

Earlier work on the control of *Cydia pomonella* (L.) on apple in the Soviet Union by mass releases of *Trichogramma* gave disappointing results, and this is attributed to the use of a form (*T. evanescens* Westw.) adapted to parasitise the eggs of Noctuids in open fields [*cf. R.A.E.*, A **45** 474]. Tests were carried out in the Stalingrad region in 1938–40 with a local form of *Trichogramma* reared from *C. pomonella* itself, and releases were made, at the rate of 2,000 parasites per tree in orchards affording different ecological conditions. In 1938, four releases were made during the season in sheltered orchards in a valley and in orchards situated at a higher altitude, two against the first and two against the second generation, combined, in the higher orchards, with sprays of Paris green and the use of trap-bands. Counts showed that the percentages of harvested fruits infested were reduced from 77·7 to 20·1 and from 87·7 to 52, respectively. A young orchard on higher ground was similarly treated, but with no effect. It is concluded that conditions in the low-lying valley orchards were more favourable to the parasite than those on the higher ground. Less favourable results were obtained in 1939, however. The percentages of eggs parasitised under natural conditions were investigated in a district in the Astrakhan region in September 1940. They varied with the variety of apple from 6·9 to 75·6 and increased with the numbers of host eggs laid on a given variety. Eggs laid on the smooth upper surfaces of the leaves were the most heavily attacked.

[RӮVKIN (B. V.)] RYWKIN (B. W.). **Die Kiefernblattwespen Weissrusslands und ihre Parasiten (Hymenoptera: Diprionidae).** [The Pine Sawflies of White Russia and their Parasites.]—*Beitr. Ent.* **7** no. 5–6 pp. 457–482. 24 refs. Berlin, 1957. (With Summaries in English & Russian.)

Five outbreaks of *Neodiprion sertifer* (Geoffr.) occurred on pine in White Russia in 1928–51, the most important in 1929–32 and 1947–49, as compared with only one of *Diprion pini* (L.), in the south of the region in 1937. Investigations on the population dynamics of these sawflies were made during this period, with particular reference to the effect of parasites. *N. sertifer* has only one generation a year, and the peak of any outbreak did not extend beyond a single generation. The adults emerged in late August or early September, and oviposition occurred soon after, the females depositing 132 eggs each in 17 needles, on the average, in 1948. The eggs overwintered, and the larvae, which hatched in May, spun cocoons in the litter when full-fed. Some gave rise to adults in the same season, but the remainder entered diapause in the eonymphal stage, and adults from these did not usually emerge until the following August–September. Eggs, larvae and eonymphs in cocoons were attacked by parasites, and the last two also by diseases. The eonymphs were particularly susceptible, and mortality in this stage at the height of any outbreak commonly exceeded 50 per cent. and sometimes reached 75 per cent., the proportions of the total cocoon population giving rise to adults in the year of development and in the following year then being each only about one-eighth. Egg production in the first year was nevertheless heavy, ranging up to 6,000–8,000 per tree. Parasitism of the eggs in the second year was high, and most of the larvae that hatched were killed by virus disease.

D. pini has two generations a year. The cocoons of the first were spun on the trees and emergence from them was never delayed by diapause, but those of the second were spun in the litter and the eonymphs overwintered, giving rise to adults in the following spring, or, if diapause was prolonged, in the one after. In favourable years, therefore, emergence is abnormally high, all the adults of the second generation of the previous year and those from cocoons remaining over from the year before that emerging together. This was the case in 1937, when emergence was favoured by the preceding long autumn and the early spring, with a short period of unusual cold in January. The weather was also favourable for the development of the larvae of both generations, so that up to 3,000 per tree were present in August–September, but most of those of the second generation were destroyed by diseases and parasites and the overwintered population in 1938 largely remained in diapause, owing to less favourable conditions, and suffered high mortality from parasites and diseases. The females that emerged laid an average of 138 eggs each, on about 11 needles, but most of the eggs were parasitised and few larvae developed.

The main parasite of the eggs of the sawflies was *Achrysocharella ruforum* (Krausse). *D. pini* was the more suitable host for it, as it had two generations a year, and the adults of the two species were present at about the same times. Other egg parasites were rare. The late-instar larvae of both species were parasitised by three Tachinids and eight Ichneumonids. All completed their development in the eonymphs, and *Exenterus amictorius* (Panz.) (*marginatorius* (F.)), *E. abruptorius* (Thnb.) and *E. oriolus* Htg. were the most important. The eonymphs were parasitised by six species of Hymenoptera, of which *Dahlbominus fuscipennis* (Zett.) was the most constant and widespread. Parasites reared in 1932 from cocoons of *N. sertifer* collected in the south of White Russia afforded a total parasitism of 39·16 per cent., comprising 20·66 per cent. by *Agrothereutes* (*Gambrus*) *adustus* (Grav.), 10·5 per cent. by *D. fuscipennis*, 3·84 per cent. by *E. oriolus*. 1·55 per cent. by *E. amictorius*, 1 per cent. by *Lophyroplectus luteator* (Thnb.) and less than 1 per cent. each for others. In 1949, *Aptesis* (*Microcryptus*) *basizona* (Grav.) was the chief parasite of *N. sertifer* in this region.

GANGOLLY (S. R.), RANJIT SINGH, KATYAL (S. L.) & DALJIT SINGH. **The Mango.**—10 × 7¼ in., xiii + 530 pp., col. frontis., 229 pls. (212 col.), 162 refs. New Delhi, Indian Coun. agric. Res., 1957. Price £4 5*s*. or $12.

In addition to chapters on the botany and cultivation of mangos in India, this book contains one (pp. 491–502) in which information is given on the bionomics and control of the various insects that damage the trees or the fruits.

EDEN (T.). **Tea.**—8¾ × 5½ in., xvi + 201 pp., 36 pls. (4 col.), 21 figs., many refs. London, &c., Longmans, Green & Co., 1958. Price £1 15*s*.

One chapter (pp. 118–135) in this book on the cultivation and manufacture of tea is concerned with the insects, mites and other invertebrate pests that attack the bushes in various parts of the world. General descriptions of their appearance and habits are given, together with notes on control and references to more detailed literature.

Concentric Ring Blotch under Control.—*Fmg in S. Afr.* **32** no. 6 pp. 9–10, 24, 5 figs. Pretoria, 1956.

A disorder of *Citrus* known as concentric ring blotch has occurred in nurseries in Southern Rhodesia, Kenya and the Transvaal since about 1914, but serious outbreaks began about 1950 and were no longer confined to nurseries; they were sporadic, but up to 90 and 100 per cent. of the fruits and leaves, respectively, of orchard trees were sometimes affected. Symptoms usually first appear on young leaves and comprise small pale blotches, of which hundreds may occur on one leaf, followed by partial or entire chlorosis, usually in the form of concentric rings, or the assumption of a dark brown or rusty colour.

Investigations on the causal agent were begun by B. J. Dippenaar in the Transvaal in 1954, and he found that high incidence was correlated with high populations of an Eriophyid mite, *Calacarus* sp., which had been known in *Citrus* orchards for some years and considered harmless. Initial symptoms developed after 10 days on orange seedlings in pots placed under infested trees and became typical within 3–4 weeks. Initial symptoms also appeared after 10 days on greenhouse seedlings to which infested leaves were attached and within 10–14 days on seedlings that were artificially infested with the mite.

In South Africa, the mite can be controlled by a spray of lime-sulphur (32 per cent. w/v polysulphides) at a concentration of 1 in 80–100, which remains effective for at least two months; micronised sulphur at 1½–3 lb. per 100 gal. water was less effective. Treatment immediately the petals have fallen and at least once again after an interval of two months is recommended.

Attafuah (A.). & Tinsley (T. W.). **Virus Diseases of** *Adansonia digitata* **L. (Bombacaceae) and their Relation to Cacao in Ghana.**—*Ann. appl. Biol.* **46** no. 1 pp. 20–22, 1 pl., 3 refs. London, 1958.

The following is largely the authors' summary. In view of the suggestion that *Adansonia digitata* may be a natural host for cacao swollen-shoot viruses in West Africa, leaves and cuttings collected from this tree in various parts of Ghana were tested for virus infection in the laboratory by means of nymphs of *Pseudococcus njalensis* Laing. Infected trees were found in the Guinea-savannah woodland of the Northern Territory and on the Accra plains, but not in the rain forest. Three viruses isolated from infected trees resembled the Kpeve cacao virus, but no definite relationship could be established. It is unlikely that the original outbreaks of swollen-shoot in cacao came from *A. digitata*, though colonies of mealybugs, including *P. njalensis* and *Ferrisiana virgata* (Ckll.), were common on the trees [*cf. R.A.E.*, A **46** 210].

Harlow (P. A.). **The Action of Drugs on the Nervous System of the Locust** (*Locusta migratoria*).—*Ann. appl. Biol.* **46** no. 1 pp. 55–73, 5 figs., 24 refs. London, 1958.

The following is virtually the author's summary. Two preparations of the hind-leg of *Locusta migratoria migratorioides* (R. & F.) were used to investigate the physiological effect of chemical compounds on nerve muscle and on the central nervous system. In the first preparation, the isolated hind-leg was made to kick regularly by electrical stimulation of the crural nerve. Test compounds were perfused in saline solution through the femur. The second preparation made use of a reflex synapsing in the metathoracic ganglion. A reflex retraction of the tibia of the hind-leg was initiated by stimulating the tarsus by heat at regular intervals; the compounds were applied in agar or paraffin blocks directly to the ganglion. In both cases the movements of the tibia or of the extensor or flexor tibialis muscles separately were recorded mechanically on a smoked drum. Acetylcholine had no action on the nervous system except for an unusual action on the nerve muscle preparation. Acetyl β-methylcholine, carbamylcholine and benzoylcholine had no action on either preparation except at high concentration. Decamethonium and *d*-tubocurarine had no effect on either preparation, while nicotine and eserine, after initial excitation, caused a simple reversible block in both preparations, the ganglion being affected at a lower concentration. Adrenalin and adrenergic drugs had no effect on either preparation. The organo-phosphorus insecticides, parathion, paraoxon and tetraethyl pyrophosphate, acted on the ganglion only and at low concentrations. Their main site of action is on the central nervous system. DDT affected ganglionic and nerve muscle preparations, whereas γ BHC acted rather similarly on the ganglion but had no effect on nerve muscle. There is no evidence for a cholinergic mechanism at the neuromuscular junction in the leg muscles. The ganglion, on the other hand, was markedly affected by the anticholinesterases tested, but acetylcholine and related cholinesterase substrates as well as drugs that interfere with the action of acetylcholine in mammals, had no effect. Acetylcholine was still without effect when injected through the membrane sheathing the ganglion. On the other hand, micro-injection experiments showed that the sheath is relatively impermeable to prostigmine.

HASSANEIN (M. H.). **Studies on the Activity, Phenology and Population Density of the Aphid Lion,** *Chrysopa vulgaris* **Schn. Chrysopidae, Neuroptera.**—*Ann. agric. Sci.* **1** no. 2 pp. 145–160, 5 figs., 12 refs. Cairo, 1956. (With a Summary in Arabic.)

Chrysopa vulgaris Schneider is of importance in Egypt in destroying aphids and the eggs and larvae of *Prodenia litura* (F.) on cotton [*cf. R.A.E.*, A **41** 415]. Light-traps were used in 1952–54 to study its population density, and observations were also made by counting at frequent intervals on sample plants. Adults were first taken in the traps on 16th March, and the population reached its peak in May and June and decreased in July, these dates being generally correlated with the occurrence of its prey on cotton. Two generations occurred in the year. The first, which was the more numerous, was active in April–June and responsible for the attack on *Aphis gossypii* Glov. and *P. litura*. The ratio of males to females was 3:2, and males were the first to be caught in the traps. Dusting with DDT, BHC or calcium arsenate led to great reductions in the predator population.

ARSENIJEVIĆ (M.). *Scythropia crataegella*—**štetna tineida na jabukama.** [*S. crataegella*—a harmful Tineid on Apple.]—*Plant Prot.* no. 38 (1956) pp. 63–66, 2 pls., 1 ref. Belgrade [1957]. (With a Summary in English.)

Larvae observed skeletonising the leaves of apple at Zemun in 1955 were identified as those of *Scythropia crataegella* (L.), which had not previously been recorded in Yugoslavia. Other plants attacked were pear, sour cherry and hawthorn [*Crataegus*], and infestation occurred also near Belgrade and in other parts of Serbia. There appeared to be more than one generation a year, and winter was passed by the larvae in cocoons at the base of the buds, from which they emerged to feed in spring. The larvae were parasitised by unidentified Tachinids and Ichneumonids.

Đurkić (J.). **Pojava** *Tetranychus atlanticus* **McGregor—štetočine poljoprivrednih kultura u Vojvodini u 1956 godini.** [An Occurrence of *T. atlanticus*—a Pest of agricultural Crops in the Vojvodina in 1956.]—*Plant Prot.* no. 38 (1956) pp. 67–70, 7 refs. Belgrade [1957]. (With a Summary in French.)

Several field crops, of which maize was preferred, were infested in the Vojvodina, north-eastern Yugoslavia, in 1956 by mites identified as *Tetranychus atlanticus* McG. [*cf. R.A.E.*, A **45** 302]. Infestation was most severe where the July rainfall was least, and light in flooded areas.

Tadić (M.) & Vasiljević (L.). **Laboratoriski rezultati ispitivanja patogenog dejstva nekih bakterija na jabučnog smotavca.** [Results of Laboratory Investigations of the Pathogenicity of some Bacteria to the Codling Moth.]—*Plant Prot.* no. 38 (1956) pp. 71–75, 1 fig., 6 refs. Belgrade [1957]. (With a Summary in English.)

In laboratory tests in Yugoslavia, a strain of *Bacillus* isolated from *Tibicen* (*Cicada*) *plebeja* (Scop.) and one of *B. thuringiensis* from *Anagasta* (*Ephestia*) *kühniella* (Zell.) were tested against larvae of *Cydia* (*Carpocapsa*) *pomonella* (L.). Sprays containing the bacteria were applied to leaves and apples on which eggs had been laid or to apples on which half-grown larvae were placed, but little effect was observed, since the larvae fed little on the surface of the fruits and entered them almost immediately.

Maceljski (M.). **Pojava kukuruznog plamenca u plodovima rajčice i paprike.** [An Occurrence of *Pyrausta nubilalis* in the Fruits of Tomato and *Capsicum*.]—*Plant Prot.* no. 38 (1956) pp. 108–109, 1 pl. Belgrade [1957]. (With a Summary in English.)

Larvae observed infesting fruits of tomato and *Capsicum* near Zagreb in late August 1956 were found to be those of *Pyrausta nubilalis* (Hb.). Infestation of maize in neighbouring fields was heavy, but the examples in the fruits were darker and smaller than those on the maize.

Wenzl (H.). **Beitrag zur Frage der Virus-Übertragung an gekeimten Kartoffeln durch die Kellerlaus** (*Rhopalosiphoninus latysiphon* **Davids.**). [Contribution to the Question of Virus Transmission to sprouted Potatoes by *R. latysiphon*.]—*Pflanzenschutzberichte* **17** pt. 5–6 pp. 65–74, 26 refs. Vienna, 1956. (With a Summary in English.)

In experiments in Austria in 1953–55, potato tubers of different varieties were split in half lengthwise and set to sprout, and one set of halves was then infested with examples of *Rhopalosiphoninus latysiphon* (Davidson) that had developed on the sprouts of virus-infected tubers, at least five aphids being transferred to each sprout. The two sets of half-tubers were planted 1–2 weeks later, by which time the sprouts were 1–3 mm. long and the aphids had increased considerably on the infested ones, and the plants were examined for virus infection at intervals until just before flowering. Leaf-roll, both the typical and the mild form, and mosaic were found, but the results were statistically significant only for one experiment with 1,605 pairs of half-tubers of one variety in 1954, in which about 5 per cent. transmission of typical leaf-roll by *R. latysiphon* was confirmed.

Bognár (S.). **A rizs magyarországi ízeltlábu (Arthropoda) kártevőiről.** [Arthropod Pests of Rice in Hungary.]—*Növenytermelés* 7 no. 2 pp. 143–152, 8 figs., 22 refs. Budapest, 1958. (With Summaries in Russian & English.)

Observations on the arthropods that injure rice in Hungary were made in 1955–57. It was found that considerable damage was done by two species of Crustacea, which grubbed up the roots of the young plants and apparently also fed on the leaves, and that the leaves were mined by *Hydrellia* sp. and also injured by the larvae of *Nymphula nymphaeata* (L.). Most damage, however, was caused by the larvae of *Chironomus plumosus* (L.), which not infrequently destroyed up to 70–100 per cent. of the young plants, and those of *Cricotopus* (*Trichocladius*) *bicinctus* (Mg.), which damaged the surface of leaves lying on the water and had not previously been observed in Hungary. An experiment in June 1957 against the larvae of *Chironomus plumosus* showed that a 10 per cent. BHC dust applied to the surface of the water at a rate affording about 2 oz. γ isomer per 1,000 sq. yd. gave almost complete control in a day.

Niklas (O. F.). **Zur Temperaturabhängigkeit der Vertikalbewegungen Rickettsiose-kranker Maikäfer-Engerlinge (*Melolontha* spec.).** [On the Dependence on Temperature of the vertical Movements of Larvae of *Melolontha* infected with rickettsial Disease.]—*Anz. Schädlingsk.* **30** pt. 8 pp. 113–116, 2 figs., 7 refs. Berlin, 1957.

Larvae of *Melolontha* infected with *Rickettsiella* (*Rickettsia*) *melolonthae* were observed near Lorsch, Germany, to come to the surface of the soil in the late autumn of 1954 and to die soon afterwards [*cf. R.A.E.*, A **46** 290]. Since the phenomenon was particularly noticeable after a rapid fall in temperature, its relation to temperature was further investigated at Lorsch in 1955–56. In 1955, larvae were present on the surface of the soil from 10th October to mid-November, and their numbers, which were lower than in the previous year, were at a maximum on 9th November. In 1956, they were present from 9th October to mid-December, and total numbers were still low, but they reached a sharp peak on 25th October. The occurrence of large numbers of larvae on the surface was often preceded by a fall in temperature, but this was not always the case, and the fall, when it did occur, was sometimes not marked. In further laboratory tests [*cf.* **46** 291], diseased second-instar larvae collected from the surface of the soil in 1955 and healthy ones reared at 21°C. [69·8°F.] were kept in tubes at various constant temperatures for 36 hours and then at lower, higher or the same temperatures for a similar period. When the larvae were first kept at 25, 18, 16 or 13°C. [77, 64·4, 60·8 or 55·4°F.] and then at 17, 13, 10 and 8°C. [62·6, 55·4, 50 and 46·4°F.], respectively, diseased ones moved predominantly from the middle of the tube to the upper part and healthy ones predominantly to the lower part, and diseased larvae showed a similar reaction when transferred from 17 or 9°C. [48·2°F.] to 4°C. [39·2°F.]. In all, 69 per cent. of diseased larvae and 8 per cent. of healthy ones moved upwards and 10 and 46 per cent., respectively, downwards. Similarly, of larvae kept at temperatures of 17, 17, 10 and 5°C. [62·6, 62·6, 50 and 41°F.] and then at 25, 20, 16 and 12°C. [77, 68, 60·8 and 53·6°F.], respectively, 45 per cent. of diseased and 15 per cent. of healthy ones moved upwards and 20 and 40 per cent., respectively, downwards, and for larvae kept for the whole time at temperatures ranging from 20 to 5°C., the corresponding percentages for upward movement were 52 and 6 and for downward movement 29 and 63. It is concluded that the effect of temperature intensifies, but is only secondary to, the normal effect of the disease.

Knoche (C.). **Die Speckkäfer als Schädlinge an importierten Häuten und Fellen.** [Dermestids as Pests of imported Skins and Hides.]—*Ent. Mitt.* no. 12 pp. [1+] 345–387, 20 figs., 73 refs. Hamburg, 1957.

Skins and hides arriving at the port of Hamburg are frequently infested and severely injured by Dermestids, and, as it was not known whether the infestation originated in the exporting country or on board ship, investigations were made from June 1955 to October 1956. Only consignments imported directly into Hamburg on ships constantly employed on the same route were examined. The species found were *Dermestes frischii* Kug., *D. haemorrhoidalis* Küst., *D. carnivorus* F., with its subsp. *dömmlingi* Meier, *D. maculatus* Deg. (*vulpinus* F.) and *D. ater* Deg. (*cadaverinus* F.). The adults and larvae of these are described, with notes on differentiating characters, and keys to them are given. The damage caused is of two kinds, that due to the feeding of adults and larvae and that due to the boring of larvae seeking pupation sites; the injury caused to skins of different types is described and illustrated. *D. frischii* was found mainly on sheepskins from Greece, goatskins and buffalo hides from India and dried salted sheepskins from South Africa, *D. haemorrhoidalis* on ox hides from South America, and *D. carnivorus* and its subspecies on peccary from Brazil and Peru, while *D. maculatus* and *D. ater* occurred in association with the others. In addition, one adult of *D. peruvianus* Lap., with which *D. haemorrhoidalis* has in the past been confused, was found on a sheepskin from Peru. The condition of the bales indicated that the peccary skins and goatskins became infested during transit, the latter mainly by pupating larvae, but many consignments of South African sheepskins appeared to have been infested before loading. *D. frischii* and *D. ater* were not found in winter or *D. haemorrhoidalis* between July and November, but *D. maculatus* and *D. carnivorus* occurred throughout the year. *Necrobia rufipes* (Deg.), the adults and larvae of which attack the pupae and freshly moulted Dermestid larvae, but of which the larvae fed on the inner side of the skins, were present in some lots. The principal methods of control are careful inspection before loading and cleanliness and ventilation in the holds, since infestation is favoured by warm damp conditions.

Beemster (A. B. R.). **Onderzoekingen over een virusziekte bij stoppelknollen** (*Brassica rapa* **var.** *rapifera*). [Investigations on a Virus Disease of Turnip.]—*Tijdschr. PlZiekt.* **63** pt. 1 pp. 1–12, 1 fig., 12 refs. Wageningen, 1957. (With a Summary in English.)

The following is based largely on the author's summary. A virus disease caused damage to turnips in Holland in 1949. The physical properties of the virus were investigated and are described, and tests are recorded in which it proved infective for numerous cruciferous and some other plants and was transmitted in the non-persistent manner by *Myzus persicae* (Sulz.) and *Brevicoryne brassicae* (L.) from turnip to turnip and tobacco. Because of its various characteristics it is thought to belong to the group of turnip virus 1 of Walker, LeBeau & Pound [*R.A.E.*, A **34** 182].

Ernould (L.) & Van Steyvoort (L.). **Atlas des ennemis et maladies de la betterave.**—[Revd. edn.] 7¾ × 5 in., 71 pp., 30 col. pls. Tirlemont, Inst. belge Amélior. Better., 1958.

This booklet contains a key to the various disorders that affect beet in Belgium, followed by notes on the organisms or other causes responsible for them. For the insects, these include general information on the symptoms of attack, the appearance and bionomics of the pests, and their control, and most of them are shown in coloured illustrations. The vectors of insect-borne virus diseases are noted.

SCHVESTER (D.). **Sur le comportement de ponte et le développement de la bruche** (*Acanthoscclides obsoletus* **Say) chez diverses variétés de haricots en stock.**—*Rev. Zool. agric.* **56** no. 7–9 pp. 120–125. Talence, 1957.

Since infestation of beans in the field in France by *Acanthoscelides obtectus* (Say) (*obsoletus*, auct.) is known to vary with the variety grown, experiments were carried out to ascertain whether variations also occur on the stored beans. Beans of four varieties were compared in oviposition tests, in which adults were confined with two varieties at a time in petri dishes kept in the dark at 26–27°C. [78·8–80·6°F.]. Differences in the percentages of eggs laid per variety occurred in each comparison, the greatest being for one pair in which they were 70·8 and 29·2, respectively. In further tests with these two varieties, the difference persisted and was found to be significant, and it was about the same for Bruchids up to 2 and up to 4 days old. There was no difference between varieties, however, in a further test in which the new generation was allowed to develop and the average number of adults emerging per infested bean (5·37–5·96) was calculated. The differences in infestation that occur are thus due to oviposition preferences.

PUSSARD (R.). **Cycle évolutif de** *Thomasiniana lavandulae* **Barnes (Dipt. Cecidomyiidae).**—*C. R. Soc. Biol.* **151** no. 3 pp. 467–470, 1 ref. Paris, 1957. **Biocénose de** *Thomasiniana lavandulae* **Barnes (Dipt. Cecidomyiidae).**—*T. c.* pp. 536–538, 3 refs.

Thomasiniana lavandulae Barnes is a pest of *Lavandula* spp., including lavender (*L. vera* (*angustifolia*)) and hybrids of it, in southern France [*cf. R.A.E.*, A **46** 362, etc.], and the first of these papers comprises an account of the bionomics of this Cecidomyiid. The eggs are laid singly or in groups through crevices in the bark, in contact with or close to the parenchyma, and the larvae develop in the living stem tissue, but do not cause the formation of galls. They become full-fed in 20–25 days at an average temperature of about 17·5°C. [63·5°F.], but remain beneath the bark until conditions become favourable for their descent to the soil. They usually leave the stems when rain falls, and they then enter the soil and construct cells, in which they pass the hot dry season, from June to October. They pupate about mid-October, and the pupae overwinter and then move to the surface of the soil, where adult emergence occurs [*cf.* **46** 206]. There is only one generation a year. The immature stages are briefly described.

The larvae of *T. lavandulae* are stated in the second paper to be parasitised by *Piestopleura flavimanus* Kieff., the males and the host of which were hitherto unknown. The process of pairing and oviposition in this Platygasterid are described. Parasitised larvae descend to the soil as usual and construct cocoons, but do not pupate, and the parasite adults make their way out through the soil. Over 10 per cent. of the cocoons gave rise to the parasite, the two sexes of which were equal in numbers. *T. lavandulae* is also attacked by numerous predators.

BOURNIER (A.). *Drepanothrips reuteri* **Uzel. Le thrips de la vigne.**—*Ann. Éc. Agric. Montpellier* **30** fasc. 1–2 pp. 145–157, 6 figs., 11 refs. Montpellier, 1957.

An account is given of observations on *Drepanothrips reuteri* Uzel in southern France, where, following mild, dry conditions favourable to the overwintering females, this thrips damaged vines in several areas in 1957, together with descriptions of all stages except the egg and of characters distinguishing it from other species that might be confused with it. American vines, especially *Vitis riparia* and its hybrids and, more rarely, *V. rupestris* were the preferred food-plants, but the thrips was also observed on oak, hazel, beech, maple and *Orchis*. The females overwintered most frequently under the bark, but they were also found in oak litter near the vineyards. They appeared on the young shoots or buds during the first warm days of April and after feeding superficially on the leaves and young shoots, oviposited under the epidermis. They laid 80–100 eggs each, singly, at a rate of 1–2 a day. Development appeared to be favoured by warm, humid conditions, and there were probably two generations a year. Long wet periods and, more particularly, heavy rain, caused high mortality in all stages. Males were scarce, and none was seen during winter or early spring.

The tissues punctured in feeding eventually turn brown. In *V. riparia*, its hybrids and other thin-leaved varieties, the necrotic tissues fall, but in thick-leaved varieties, such as *V. vitis*, holes rarely develop, though infested leaves shrivel. The thrips attack the newly opened buds, and the second and third leaves, which often wither completely following feeding on the petiole, are especially vulnerable. The flowers and flower stalks are also attacked, and this reduces or prevents fruiting. Infested shoots become stunted. Under conditions favourable to the thrips, damage continues through the summer, and characteristic corky patches may even develop on the epidermis of the fruits.

Sprays of parathion, DDT or γ BHC are suggested for control, and an application after bud-burst, followed where necessary by another ten days later, should give adequate protection.

Protection des constructions contre les termites en France.—FD X no. 40-501, 12 pp., 2 pls., 2 figs. Paris, Ass. franç. Normalisation, 1957.

The termites that occur in France are *Kalotermes flavicollis* (F.), which occurs in the south, *Reticulitermes lucifugus* (Rossi), in the south and south-west, and *R. lucifugus* subsp. *santonensis* Feytaud, in the west and the Paris region. As a rule, only the last two are injurious to structural timbers, and in this publication, which is from the French Standards Association, methods of detecting, preventing and controlling infestations in buildings are set out.

Sweetman (H. L.). **The Principles of Biological Control. Interrelation of Hosts and Pests and Utilization in Regulation of Animal and Plant Populations.**—[Revd. edn.] $11\frac{1}{4} \times 8\frac{1}{2}$ in., xii + 560 pp., frontis., 328 figs., $48\frac{1}{2}$ pp. refs. Dubuque, Iowa, W.C. Brown Co., 1958. Price $8.75.

This text-book has the same scope as the author's earlier work on the subject [*R.A.E.*, A **25** 101], which has been considerably revised and extended in the light of more recent work on the biological control of both insects and weeds. It is intended for students and research workers and is arranged so that selected portions can be studied without a break in continuity.

Huffaker (C. B.). **Experimental Studies on Predation: Dispersion Factors and Predator-Prey Oscillations.**—*Hilgardia* **27** no. 14 pp. 343–383, 19 figs., 15 refs. Berkeley, Cal., 1958.

The following is virtually the author's summary. An experimental study of the rôle of dispersion in the predator-prey relation was made, using the predatory mite, *Typhlodromus occidentalis* Nesbitt, and the phytophagous mite, *Eotetranychus sexmaculatus* (Ril.), as the prey. Earlier experimental work by G. F. Gause and associates [*R.A.E.*, A **24** 554] had led to some acceptance among ecologists of the view that the relation is inherently self-annihilative and that continuation of it, or coaction, is dependent upon either immigrations into the depopulated areas from without or the existence of refuges inaccessible to the predators.

In the study reported, a wide variety of different arrangements in dispersion of plant food (and microhabitat) was tested experimentally. In all the simple universes employed, the conclusions of Gause with respect to the predator, but not to the prey, seemed to apply. The unacceptability of that view was demonstrated by the use of a larger, much more complex universe utilising wide dispersion and incorporating also partial barriers, thus increasing still further the relative dispersion while still not incorporating restrictive refuges. By this method, predator-prey coaction was maintained for three successive oscillations. It is thus quite probable that a controlled, experimental ecosystem can be established in which the predator-prey coaction would not be inherently self-annihilative. It is believed also that various damping mechanisms would come into play, which would serve to modify the theoretically sound concept that oscillations arising from this coaction are inherently of increasing severity in amplitude.

The whole controversy becomes rather more theoretical than factual, considering that the earlier view incorporated the purely relative concept of immigration of new stock from without, and any distinction between immigration or emigration and any movement at all on the part of the participants can hardly be upheld. The suggestion seems more appropriate that artificial universes are inadequate if they do not give possibility of expression of the major parameters intrinsic to the specific predator-prey coaction in the natural habitat, and that conclusions drawn from such data as to principles have limited value. The success obtained in sustaining such a coaction under experimental conditions is probably a measure of the degree to which the inherent essentials were duplicated.

In the study, arbitrary selection of different degrees of dispersion and segmentation of the units of food for the prey was accomplished without altering the number of surfaces to be searched, and, when desired, without altering the total amounts of food used. This was done by covering oranges to various degrees, leaving known exposed portions, and dispersing them as desired among waxed rubber balls of the same size. The technique offers possibilities of elaborate and varied studies. For example, further modifications could make it possible to study the predator-prey relation with greater assurance against overexploitation, and, thus, various other features, such as the introduction of a competing predatory species or a competing prey species, could be introduced in order to study their relations to the periods and amplitudes of the oscillations. By elaboration along these lines it should be possible to establish empirically whether employment of quite diversified agricultures may offer prospects of relief from insect pests, in comparison with extensive cultivations of single crops.

Boudreaux (H. B.). **The Effect of relative Humidity on Egg-laying, Hatching, and Survival in Various Spider Mites.**—*J. Insect Physiol.* **2** no. 1 pp. 65–72, 1 fig., 9 refs. London, 1958.

Outbreaks of Tetranychid mites have long been known to be favoured by hot, dry weather and checked by highly humid conditions, presumably as a result of population reduction. Feeding proceeds at a high rate during the oviposition period, and in view of a suggestion that the rate of feeding in mites might vary inversely with relative humidity because of the high evaporation rate resulting from their high ratio of surface area to body volume, experiments were carried out in Louisiana to measure the effects of relative humidity on feeding as expressed by egg-laying. Stock cultures of six species were maintained on cotton seedlings in summer at temperatures of 75–95°F. and relative humidities of 95–100 per cent. or 35 per cent. or less. The technique is described. The number of eggs laid per mite and the length of the oviposition period were significantly greater at low than at high relative humidity in *Tetranychus telarius* (L.), *T. cinnabarinus* (Boisd.) [*cf. R.A.E.*, A **46** 261], *T. lobosus* Boudreaux [*cf. loc. cit.*], *T. tumidus* Banks (on one but not another variety of cotton), and *T. desertorum* Banks. The eggs of *T. cinnabarinus* did not hatch. The percentage hatch and the percentage of nymphs surviving in the other species were usually greater at low than at high humidity, though not significantly so in all; the newly hatched mites survived poorly at the high humidity. None of 18 females of *T. gloveri* Banks [*cf.* **47** 132] oviposited at low humidity; only one did so at high humidity, and none of the eggs hatched. Subsidiary tests with *T. telarius* showed that the cuticle of summer females is easily permeated by water and that examples kept on cotton at high and low humidity contained similar percentages of body moisture. It is suggested that greenhouse populations on suitable plants could be kept to a minimum by the provision of extremely high relative humidity.

PAPERS NOTICED BY TITLE ONLY.

GIANG (P. A.) & CASWELL (R. L.). **Polarographic Determination of O,O-Dimethyl 2,2,2-Trichloro-1-hydroxyethylphosphonate (Bayer L 13/59)** [(Dipterex) in technical products and formulations].—*J. agric. Fd Chem.* **5** no. 10 pp. 753–754, 11 refs. Easton, Pa., 1957.

BROKKE (M. E.), KIIGEMAGI (U.) & TERRIERE (L. C.). **A Spectrophotometric Determination of 2-(p-tert-Butylphenoxy)-1-methylethyl 2-Chloroethyl Sulfite (Aramite) Residues** [on crops].—*J. agric. Fd Chem.* **6** no. 1 pp. 26–27, 1 fig., 5 refs. Easton, Pa., 1958.

GROVES (K.). **Analysis of Mixtures of Isomers of Demeton** [diethyl 2-(ethylthio)ethyl phosphorothioate].—*J. agric. Fd Chem.* **6** no. 1 pp. 30–31, 9 refs. Easton, Pa., 1958.

BANN (J. M.) & others. **Determination of Endrin in agricultural Products and Animal Tissues.**—*J. agric. Fd Chem.* **6** no. 3 pp. 196–202, 4 figs., 7 refs. Easton, Pa., 1958.

DUNN (C. L.). **Determination of 2,3-p-Dioxanedithiol S,S-bis(O,O-Diethyl Phosphorodithioate)** [on crops].—*J. agric. Fd Chem.* **6** no. 3 pp. 203–209, 2 figs., 17 refs. Easton, Pa., 1958.

DEWEY (J. E.). **Utility of Bioassay in the Determination of Pesticide Residues** [a review of techniques].—*J. agric. Fd Chem.* **6** no. 4 pp. 274–281, 107 refs. Easton, Pa., 1958.

THE INSECT PESTS OF COTTON IN TROPICAL AFRICA

by E. O. PEARSON

Director, Commonwealth Institute of Entomology,
formerly Senior Entomologist, Empire Cotton Growing Corporation

Bound in cloth. Royal 8vo. Pages x and 355, 8 coloured plates, 16 text figures and over 750 references.

Price 40s. post free

Cotton is one of the most important crops cultivated in tropical Africa and no comprehensive account exists of the numerous pests that attack it in that continent. The present work provides a concise and critical résumé of the available information, formerly scattered through the literature, to which a full bibliography is given, and much hitherto unpublished information is also included.

The book contains two introductory sections, the first dealing with the structure of the cotton plant and the background to its cultivation in tropical Africa, and the second giving a general account of cotton pests as regards the systematic groups to which they belong, their geographical distribution and the nature of their association with cotton, together with a summary of what insects and diseases affect the different parts of the cotton plant in Africa, and a discussion of the effects of insect attack on yield. Brief notes are given on each of the cotton-growing areas in Africa south of the Sahara and their principal pests. There is a key to the disorders affecting cotton in Africa, based on symptoms visible in the field.

The main section of the book consists of an account of each of the more important pests, dealing with the taxonomy and distribution, appearance of the different stages, life-history and seasonal activity, nature of the damage inflicted on cotton, alternative host plants, natural enemies, factors affecting prevalence, and control. In the case of species or groups that are not confined to tropical Africa, relevant matter available from research on them elsewhere is included.

Obtainable from:

The Commonwealth Institute of Entomology, 56, Queen's Gate, London, S.W.7.

FAO Plant Protection Bulletin

A Publication of the

World Reporting Service on Plant Diseases and Pests

THIS Bulletin is issued as a medium for the dissemination of information received by the World Reporting Service on Plant Diseases and Pests, established in accordance with the provisions of the International Plant Protection Convention, 1951. It publishes reports on the occurrence, outbreak and control of pests and diseases of plants and plant products of economic significance and related topics, with special reference to current information. No responsibility is assumed by FAO for opinions and viewpoints expressed in the Bulletin.

Manuscripts for publication, or correspondence regarding the World Reporting Service, should be addressed to Dr. Lee Ling, Plant Production Branch, Agriculture Division, FAO, Viale delle Terme di Caracalla, Rome, Italy; subscriptions and other business correspondence to Documents Sales Service, FAO, Viale delle Terme di Caracalla, Rome, Italy.

The Bulletin is issued monthly in English, French, and Spanish, twelve numbers constituting a volume. Subscription rates are $3.00 or 15s. per annum; single numbers are priced at $0.30 or 1s. 6d. The citation is FAO Plant Protection Bulletin, or, in abbreviation, FAO Plant Prot. Bull.

THE ASSOCIATION OF ANTS WITH APHIDS AND COCCIDS

By G. E. J. NIXON, B.A.

(With a Foreword by W. J. Hall, C.M.G., M.C., D.Sc.)

A review of the literature with special reference to the rôle of the ants where the association is believed to be connected with the transmission of crop diseases.

Royal 8vo. 36 pp. Paper Covers. Price 5s. post free.

Orders should be addressed to *The Director, Commonwealth Institute of Entomology, 56, Queen's Gate, London, S.W.7.*

INDEX OF AUTHORS

ANON., 148, 154.
Almeida, P. R., 138.
Anderson, N. H., 118, 125.
Arnol'di, K. V., 142.
Arsenijević, M., 149.
Arthur, B. W., 140.
Attafuah, A., 148.
Auerbach, S. I., 130.

Baerends, G. P., 140.
Bagdavadze, A. I., 143.
Bann, J. M., 156.
Barnes, M. M., 141.
Beemster, A. B. R., 152.
Blake, J. R., 139.
Bognár, S., 151.
Boudreaux, H. B., 132, 155.
Bournier, A., 153.
Brokke, M. E., 156.
Brown, H. M., 134.
Brown, N. R., 120.
Brown, W. J., 140.
Buckell, E. R., 128.
Burnett, T., 140.
Butenandt, A., 140.

Calcagnolo, G., 138.
Casida, J. E., 140.
Cass, L. M., 124.
Caswell, R. L., 156.
Chant, D. A., 120.
Chapman, J. A., 129.
Chisholm, D., 125.
Chung (Chi-chien), 142.
Clark, R. C., 120.
Colhoun, E. H., 120.
Cook, J. W., 139.
Cromartie, R. I. T., 140.

Daljit Singh, 147.
Davey, K. G., 124.
Davis, G. R. F., 131.
Day, M. F., 140.
De Santis, L., 137.
de Souza jr., M. F., 138.
Dewey, J. E., 156.
Dodge, H. R., 136.
Dolidze, G. V., 144.
Doutt, R. L., 140.
Downing, R. S., 124, 127.
Dunn, C. L., 156.
Durkić, J., 150.

Eden, T., 147.
Ernould, L., 152.

Finlayson, D. G., 128.
Finlayson, L. R., 119.
Finlayson, T., 119.
Fitzhugh, O. G., 139.
Flitters, N. E., 132.
Forbes, A. R., 128.
Frawley, J. P., 139.
Fulton, H. G., 127, 129.
Furniss, M. M., 136.

Gangolly, S. R., 147.
Garman, P., 120.
Giang, P. A., 156.
Giannotti, O., 138.
Grace, T. D. C., 140.
Groves, K., 156.
Guagliumi, P., 136.
Guagliumi, R., 137.
Gunther, F. A., 139.
Guyer, G. E., 134.

Haines, R. G., 134.
Harcourt, D. G., 122.
Harlow, P. A., 148.
Hassanein, M. H., 149.
Hornstein, I., 139.
Howden, H. F., 130.
Hsia (Sun-yun), 142.
Hudon, M., 121.
Huffaker, C. B., 140, 154.

Ibarra Grasso, A., 137.

Jellison, W. L., 141.
Johnson, P. C., 136.

Kalandadze, L. P., 143.
Karlson, P., 140.
Katyal, S. L., 147.
Kennedy, J. S., 140.
Kharazishvili, K. V., 145.
Kiigemagi, U., 156.
Kinghorn, J. M., 129.
Knoche, C., 152.
Kovaleva, M. F., 146.
Kuznetsov, V. I., 145.

Lange jr., W. H., 141.
Leiderman, L., 138.
Lewis, S. E., 140.
Linsley, E. G., 140.
Liu (Yu-ch'iao), 141.
Lung (Cheng-te), 141.

McDunnough, J. H., 117.
Maceljski, M., 150.

Manson, G. F., 124.
Martin, Hubert, 141.
Mathys, G., 117.
Messenger, P. S., 132, 140.
Millán, E., 137.
Monteith, A. E., 120.
Morgan, C. V. G., 118, 125.

Nagasawa, S., 141.
Neilson, W. T. A., 119.
Niklas, O. F., 151.

Otkhmezuri, L. T., 144.

Paradis, R. O., 118.
Pond, D. D., 125.
Proverbs, M. D., 126.
Pussard, R., 153.
Putman, W. L., 123.

Ranjit Singh, 147.
Rose, A. H., 122.
Ruckes jr., H., 133.
Russell, P. F., 141.
Rȳvkin, B. V. (Rywkin, B. W.), 146.

Schuder, D. L., 136.
Schvester, D., 153.
Sekhar, P. S., 130.
Semenov, A. E., 145.
Shih (Chen-hua), 141.
Smith, R. F., 140.
Spencer, G. J., 128.
Steinhaus, E. A., 140.
Stroyan, H. L. G., 140.
Suzdal'skaya, M. V., 145.
Swales, J. E., 125.
Sweetman, H. L., 154.

Tadić, M., 150.
Tanada, Y., 140.
Terrell, T. T., 136.
Terriere, L. C., 156.
Tinsley, T. W., 148.

Van Steyvoort, L., 152.
Vasiljević, L., 150.
Vega, J., 137.

Wei (Hung-chuen), 142.
Wells, A., 134.
Wenzl, H., 150.
Wigglesworth, V. B., 140.
Winteringham, F. P. W., 140.
Wishart, G., 120.
Wood, G. W., 119.

NOTICES

Secretaries of Societies and Editors of Journals willing to exchange their publications with those of the Institute are requested to communicate with the Director. Authors of papers on economic entomology, whether published in entomological journals or not, are invited to send reprints to the Director for notice in the *Review*.

The Executive Council of the Commonwealth Agricultural Bureaux is a signatory to the Fair Copying Declaration, details of which can be obtained from the Royal Society, Burlington House, London, W.1.

The Annual Subscription, *in advance*, **to a volume of the** *Review* **Series A (Agricultural) is 60s. post free; Series B (Medical and Veterinary), 30s. post free. Prices of Back Volumes on application.**

Orders and Subscriptions should be sent to the Director, Commonwealth Institute of Entomology, 56, Queen's Gate, London, S.W.7, or through a bookseller.

CONTENTS.

PAGE
AFRICA: *Calacarus* sp. injuring *Citrus* in the Transvaal 148
AFRICA: Relation of *Adansonia digitata* to Cacao Swollen-shoot 148
AFRICA: Activity of *Chrysopa vulgaris* in Cotton Fields in Egypt 149
ARGENTINA: *Phylloxera vitifoliae* in the Cuyo Region 137
ARGENTINA: *Penthaleus major* and *Petrobia latens* infesting Cereals ... 137
ARGENTINA: Hymenopterous Parasites of *Rhyacionia buoliana* 137
AUSTRIA: *Rhopalosiphoninus latysiphon* and Transmission of Potato Viruses 150
BELGIUM: The Pests of Beet (*Review*) 152
BRAZIL: Concentrated Sprays against *Leucoptera coffeella* 138
BRAZIL: Insecticide Seed Treatments applied to Cotton 138
CANADA: The Mites of the Complex of *Bryobia praetiosa* 118
CANADA: Damage to Apples by *Conotrachelus nenuphar* in Quebec 118
CANADA: Notes on Cutworms attacking Blueberry in New Brunswick ... 119
CANADA: The Bionomics and Importance of *Leucopis obscura* 120
CANADA: *Phryxe vulgaris* parasitising *Pieris rapae* 121
CANADA: The Life-history of *Monochamus scutellatus* 122
CANADA: The Bionomics of *Plutella maculipennis* near Ottawa 122
CANADA: Coccinellids feeding on Pests of Peach 123
CANADA: Larvae of *Leptinotarsa decemlineata* dispersing from Potato ... 124
CANADA: Sprays against Hemiptera on Lucerne 124
CANADA: Trials with new Acaricides in British Columbia 124
CANADA: The Weathering of DDT Deposits on Potato 125
CANADA: Effects of Fungicides on Mites on Apple 125
CANADA: Control of Soft Scales in Orchards in British Columbia 126

[*Continued on p. iv of cover*

CONTENTS—*cont.*

PAGE

Canada: Soil Insecticides against *Epitrix tuberis* on Potato 127
Canada: The Control of *Bryobia praetiosa* in Houses 127
Canada: *Hylemyia* spp. on Crucifers in British Columbia 128
Canada: Sarcophagid Parasites of Grasshoppers in British Columbia ... 128
Canada: *Tetranychus telarius* injuring Potato in British Columbia 129
Canada: Effect of Log Age on Attack by *Trypodendron lineatum* 129
Canada: Studies on the Feeding of *Ctenicera aeripennis destructor* ... 131
China: The Life-history and Parasites of *Dendrolimus superans* 141
China: *Telenomus* spp. parasitising the Eggs of *Dendrolimus punctatus* 141
China: BHC controlling Wireworms and Lamellicorn Larvae 142
China: Parasites of Insect Pests of Rice in Hunan 142
Europe: A Survey of the Natural Enemies of *Hylemyia* spp. 120
France: Oviposition Preferences of *Acanthoscelides obtectus* on Beans ... 153
France: Bionomics and Natural Enemies of *Thomasiniana lavandulae* ... 153
France: *Drepanothrips reuteri* injuring Vines 153
France: Measures against Termites 154
Germany: Rickettsial Disease and the Movement of Melolonthid Larvae 151
Germany: Dermestids found on imported Skins and Hides 152
Hawaii: Temperature and the Development of Fruit-fly Eggs 132
Holland: An Aphid-borne Virus Disease of Turnips 152
Hungary: Insects and other Arthropods damaging Rice 151
India: The Insect Pests of Mango (*Review*) 147
Switzerland: The Mites of the Complex of *Bryobia praetiosa* 117
U.S.S.R.: Observations during an outbreak of *Eurygaster integriceps* ... 142
U.S.S.R.: *Rhagoletis cerasi* in Georgia and its Control 143
U.S.S.R.: Effects of environmental Conditions on *Mamestra brassicae* ... 144
U.S.S.R.: Insecticides against *Planococcus citri* on Vines 144
U.S.S.R.: The Bionomics of *Stenolechia gemmella* in Georgia 145
U.S.S.R.: Chrysopid Larvae disseminating *Beauveria bassiana* 145
U.S.S.R.: A new Species of *Acrolepia* on Onions 145
U.S.S.R.: Effectiveness of *Trichogramma* against *Cydia pomonella* 146
U.S.S.R.: Population Dynamics of Pine Sawflies in White Russia ... 146
U.S.A.: Studies on *Asaphes fletcheri*, a Hyperparasite of Aphids 130
U.S.A.: The Status of *Tetranychus tumidus* 132
U.S.A.: Coleoptera injuring Pine Cones in California 133
U.S.A.: Systemic Insecticides controlling *Mayetiola destructor* 134
U.S.A.: Tests of new Compounds against Pests of Fruit 134
U.S.A.: Use of a Virus against *Neodiprion sertifer* in Indiana 136
U.S.A.: Aerial Spraying against *Choristoneura fumiferana* in Montana and Idaho 136
Uruguay: Hymenopterous Parasites of *Rhyacionia buoliana* 137
Venezuela: Further Records of Insects associated with Sugar-cane ... 136
Venezuela: An unusual Outbreak of a Grasshopper 137
Yugoslavia: A first Record of *Scythropia crataegella* 149
Yugoslavia: *Tetranychus atlanticus* infesting Field Crops 150
Yugoslavia: Bacterial Sprays ineffective against *Cydia pomonella* ... 150
Yugoslavia: *Pyrausta nubilalis* infesting Tomato and *Capsicum* 150
The Synonymy of Species of *Coleophora* 117
Influence of Adult Food on early Stages of *Aptesis basizona* 119
Generic Classification of the *Typhlodromus* Complex 120
Effects of γ-Radiation on *Trogoderma sternale* 130
Effect of Light on the Properties of Parathion 139
Spectrophotofluorometry for Insecticide Determinations 139
Persistence of Residues of AC–528 on Oranges and Lemons 139
A new Phosphonate Insecticide 140
Annual Review of Entomology, Vol. 4 (*Review*) 140
The Scientific Principles of Crop Protection (*Review*) 141
The Insect Pests of Tea (*Review*) 147
Action of Drugs on the Nervous System of *Locusta migratoria* 149
The Principles of Biological Control (*Review*) 154
Observations on the Predator-Prey Relation 154
Effects of relative Humidity on Egg-laying and Survival of Tetranychids ... 155
Polarographic Determination of Dipterex (*Title only*) 156
Spectrophotometric Determination of Aramite Residues (*Title only*) 156
Analysis of Mixtures of Demeton Isomers (*Title only*) 156
Determination of Endrin in agricultural Products and animal Tissues (*Title only*) 159
Determination of 2,3-p-Dioxane S,S-bis(O,O-Diethyl Phosphorodithioate) (*Title only*) 156
Bioassay in the Determination of toxic Residues (*Title only*) 156

Printed in Great Britain by The Eastern Press, Ltd., London and Reading